Using Whiteboards to Support Scientific Practices in Introductory Labs

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Course Transformation at UW

Algebra-based Physics 1 & 2
(Each ~500 students/semester)

Lectures

Prelectures

Discussions

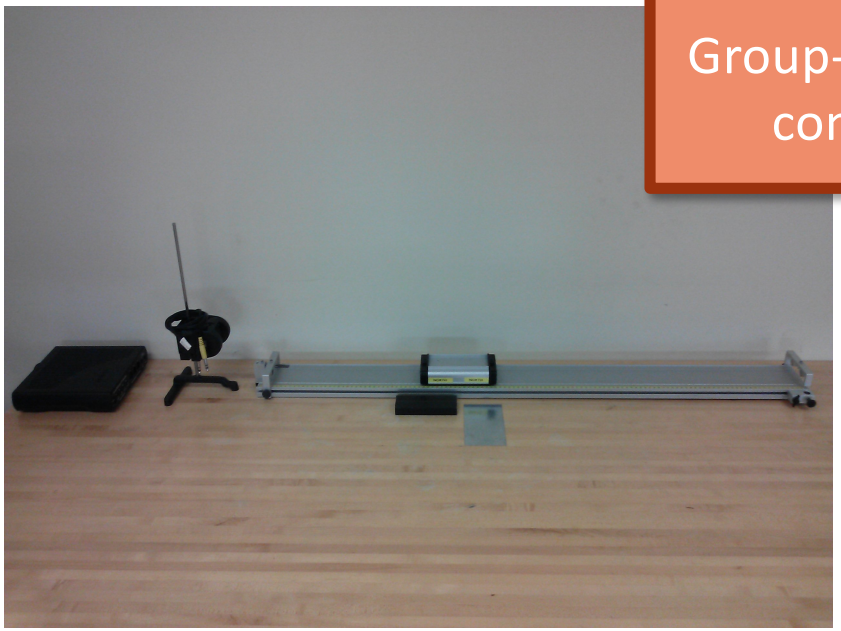
Active Learning

Labs

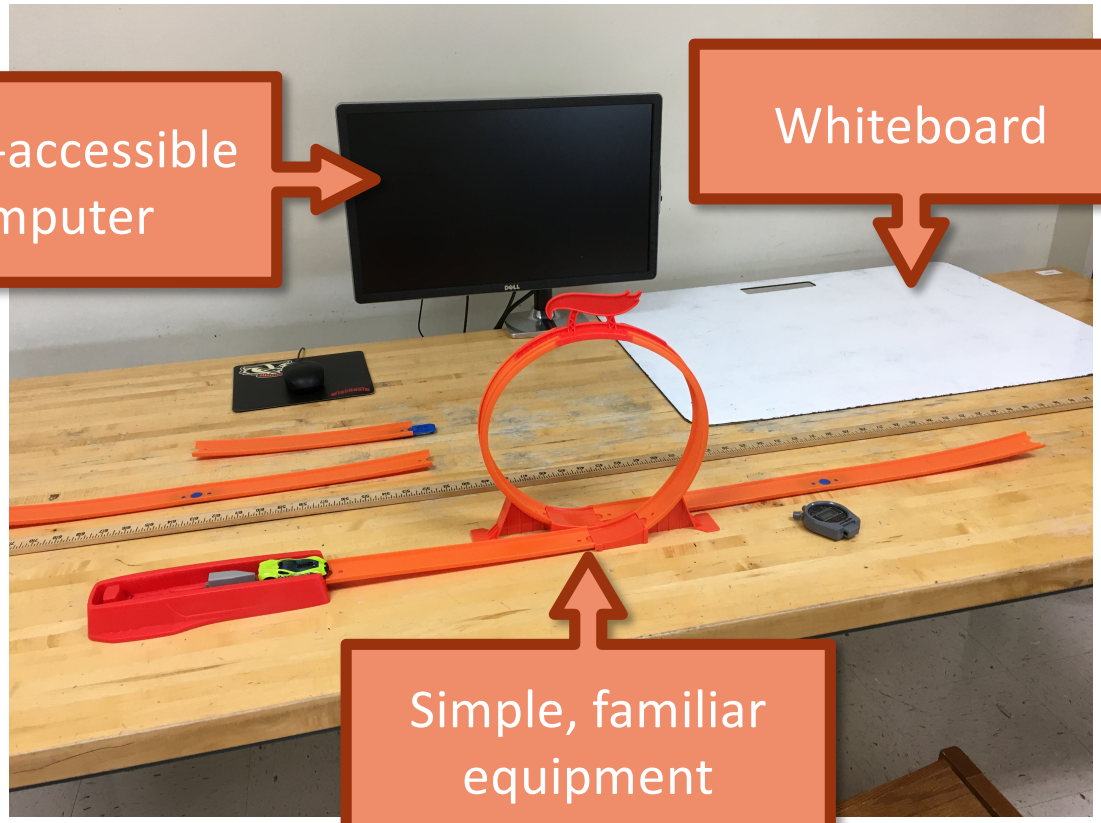
Guiding Principles for New Labs

- **Open-Ended Design**
  - "Capstone" of each lab is a **design challenge** with multiple possible solutions
- **Communication**
  - **Whiteboards** facilitate collaboration & communication
  - Mid-lab **"symposium"** provides forum to share ideas
- **Conceptual Scaffolding**
  - First half of lab **builds up** & **reinforces** principles that will be used in design challenge

Comparison of Lab Setups



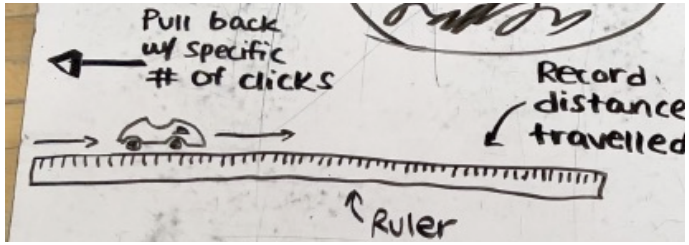
Traditional



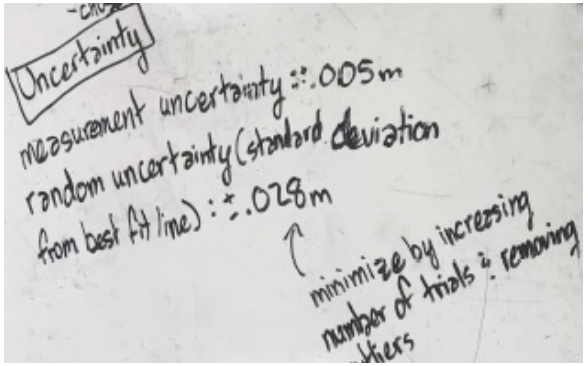
Design-based

Grading Dimensions

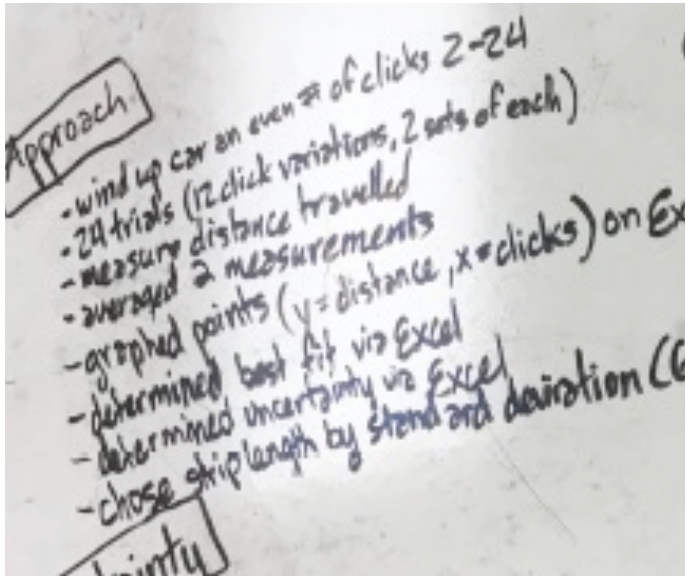
Diagram of Setup



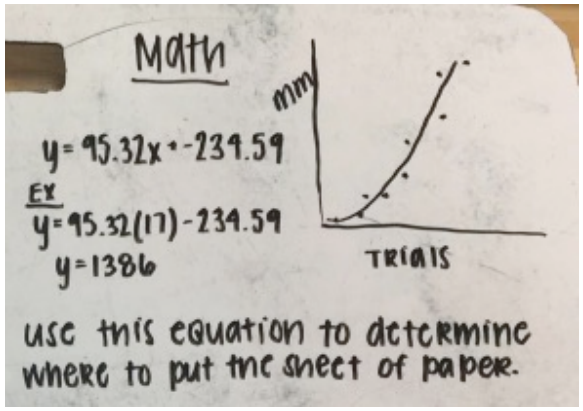
Uncertainty & Assumptions



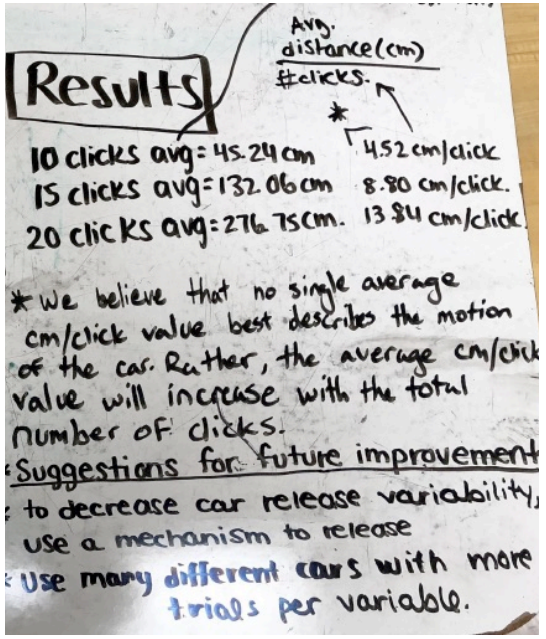
Description of Approach



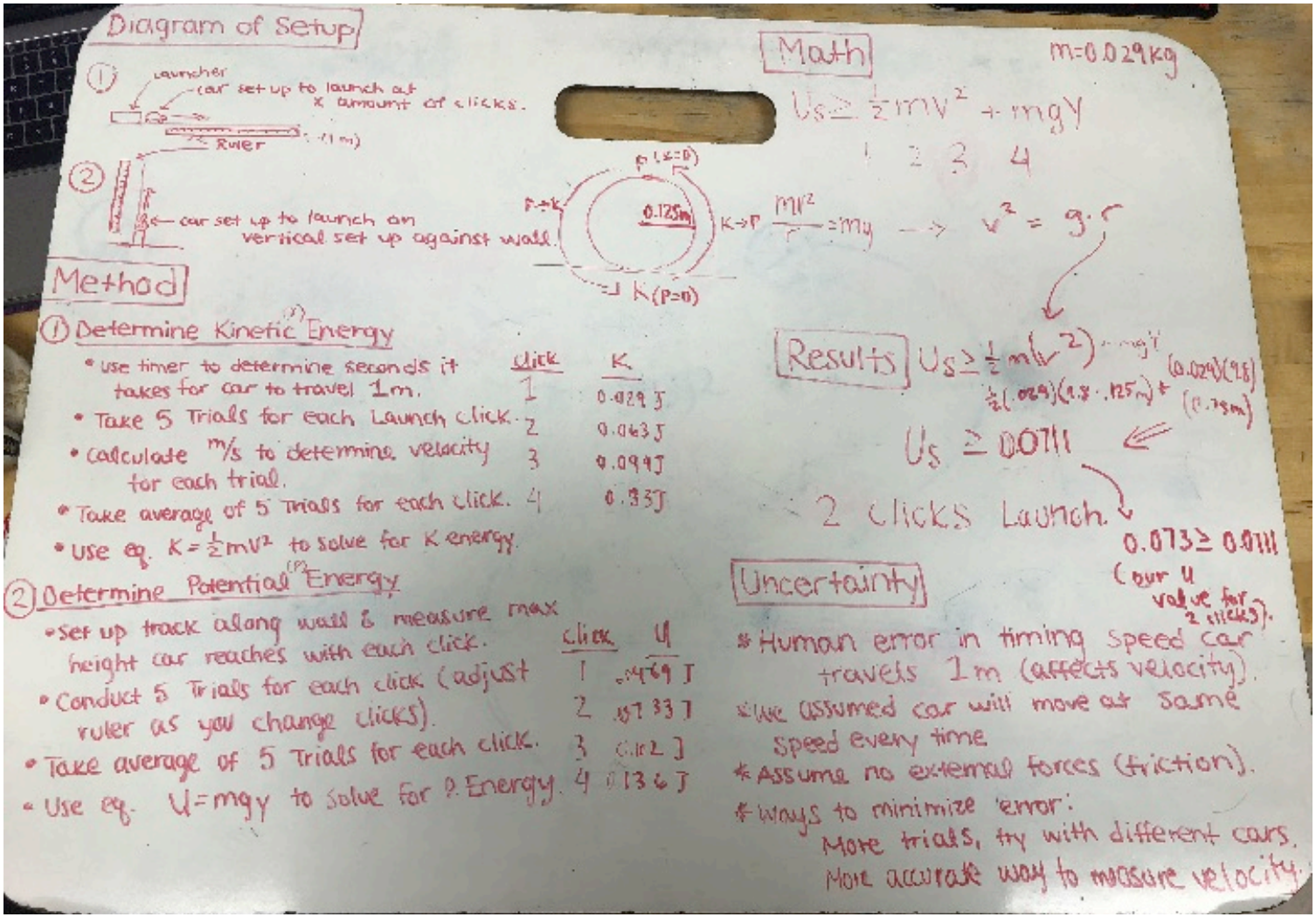
Mathematical Procedure



Results



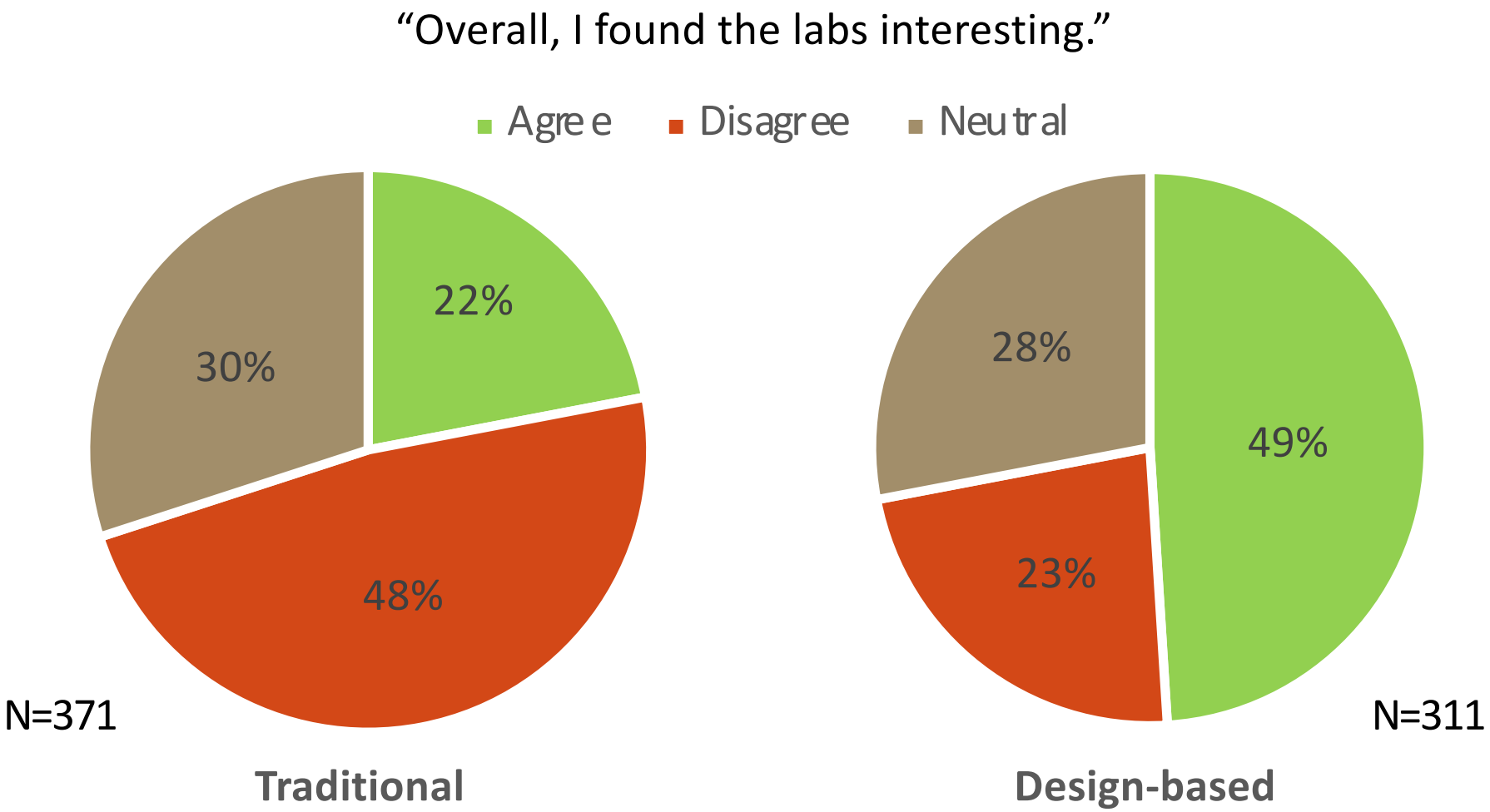
Sample Whiteboard



Post-semester Survey (Sp '18)

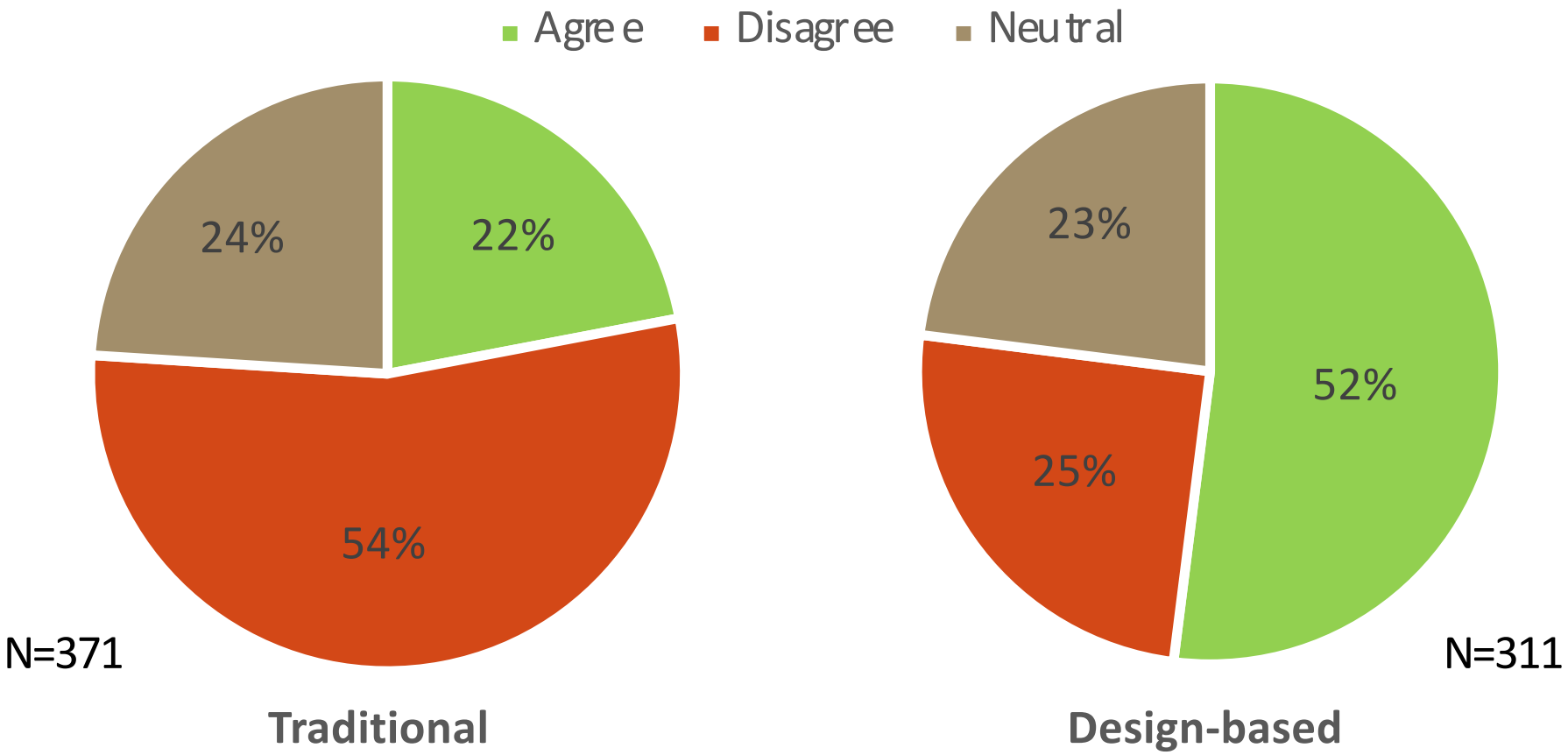
- 12 questions, 5-point Likert scale
  - Strongly Disagree – Disagree – Neutral – Agree – Strongly Agree
- Administered with post-semester conceptual inventories during lab
- "Traditional" = Algebra-based Physics 2
- "Design-based" = Algebra-based Physics 1

Results: Interest



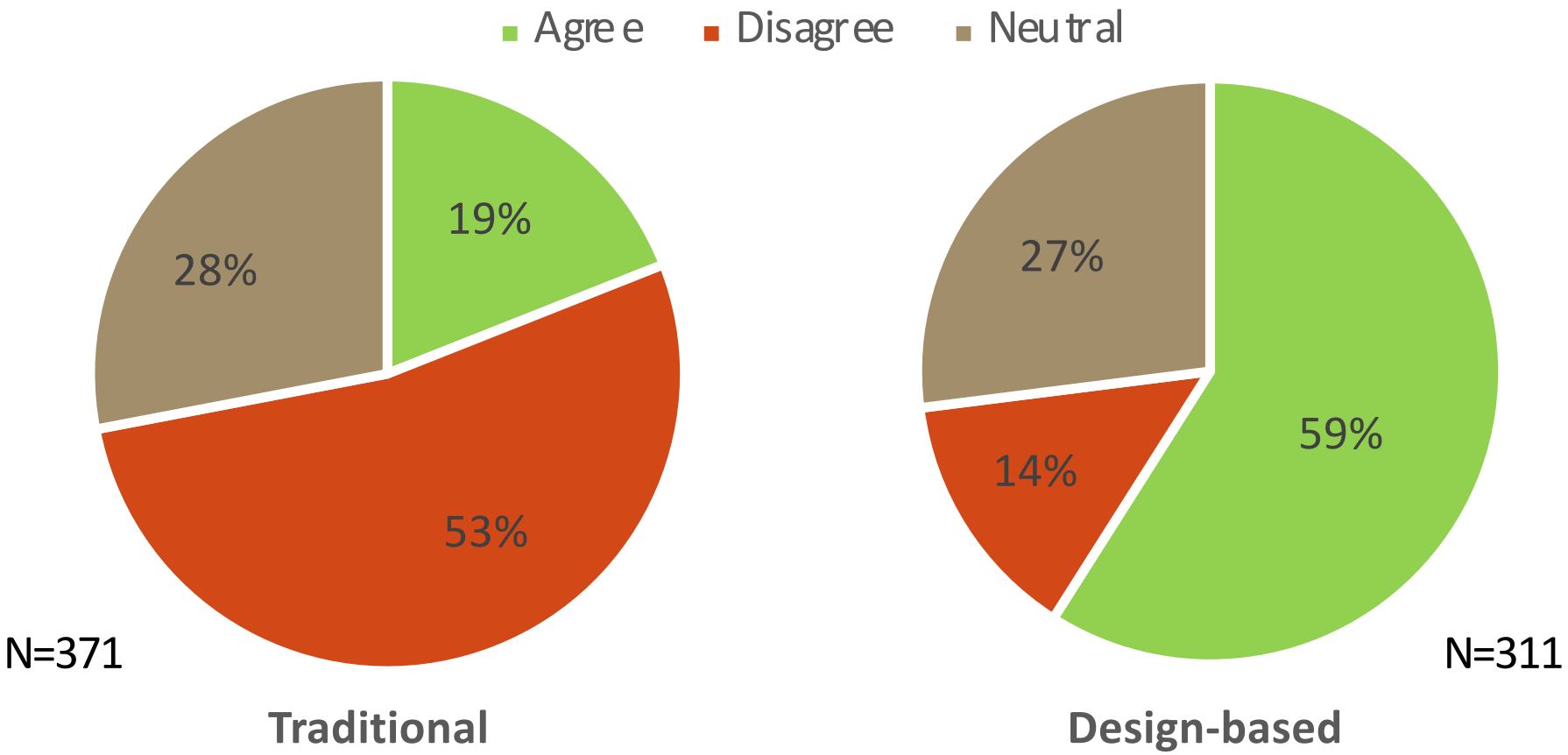
Results: Concept development

"The labs improved my understanding of physics concepts."



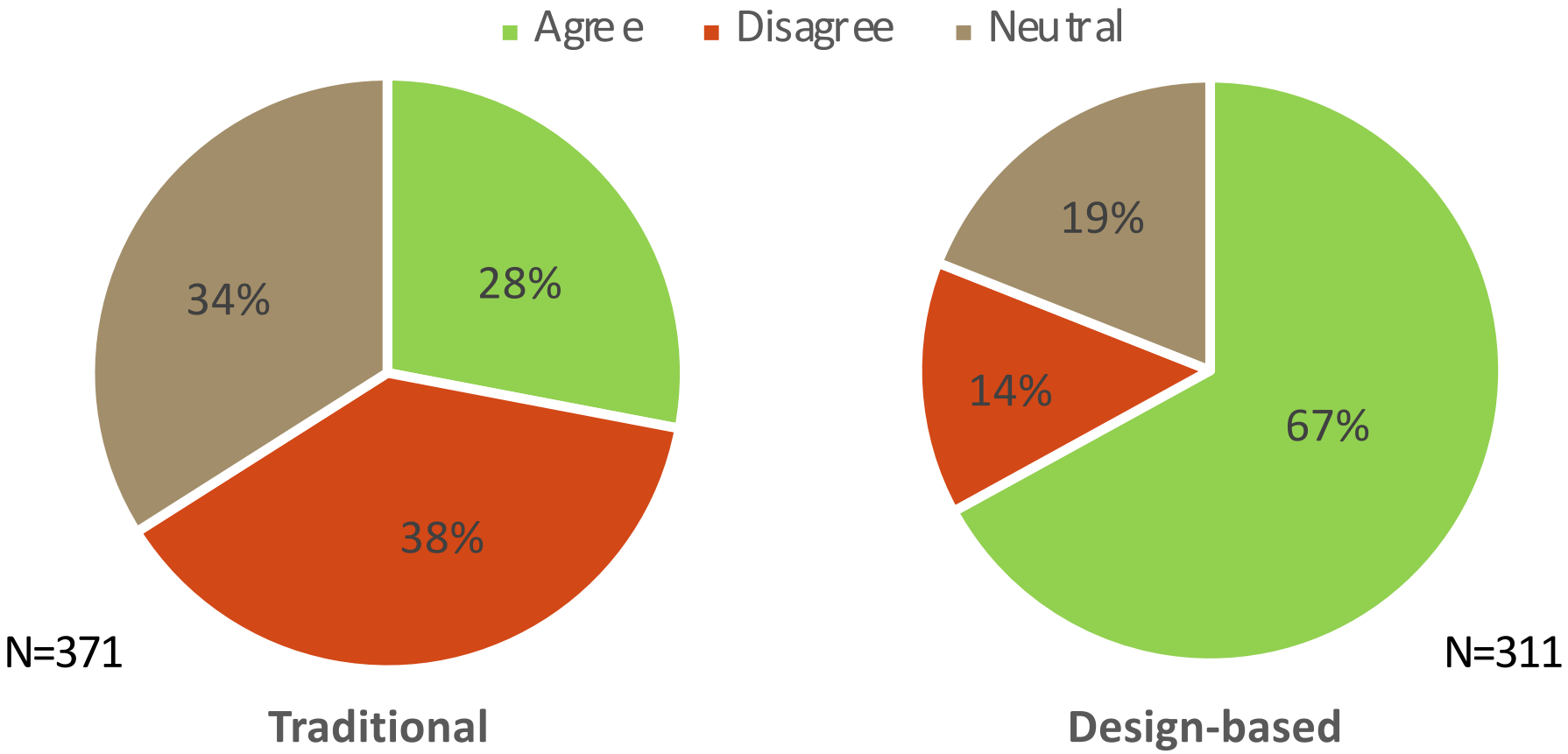
Results: Creativity

"I felt like I had to think creatively in order to be successful at the labs."



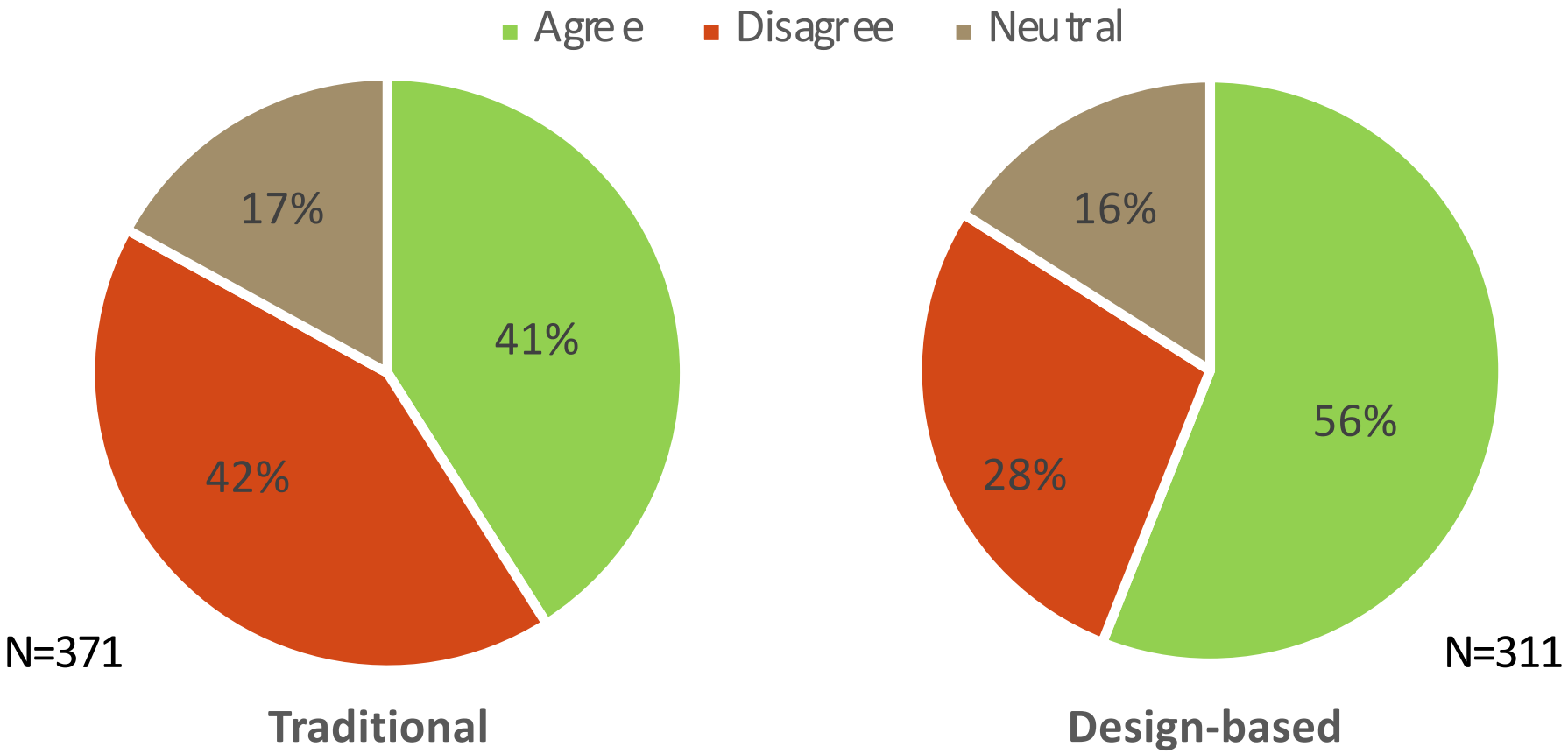
Results: Creativity

"I felt like there was usually more than one correct way to accomplish the lab activities."



Results: Communication

"In a typical lab this semester, I would discuss my results and/or procedure with another lab group."



Summary

- We have introduced a new **introductory laboratory model** at UW-Madison
- Preliminary results show positive trends in student **interest**, **creativity**, & **conceptual development**
- Room for improvement regarding **symposium** implementation

➢ **Future Directions**

- Expand lab model to other courses
- Conduct classroom observations & interviews

Contributors

Faculty	Staff	Students
Peter Timbie	Ben Spike	Tor Odden
Duncan Carlsmith	Daniel Thurs	Andrew Loveridge
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Albrecht Karle	Jim Reardon	

➢ Supported by **REACH Initiative** @ UW-Madison