Online Collaborative Lab Reporting Environment

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SALTISE
Supporting Active Learning & Technological Innovation in Studies of Education
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Can you see what's wrong with this?

(paraphrasing)

In conclusion, our experiment was successful since we were able to measure the gravitational field g to be 9.63 ± 0.72 m/s^2, consistent with the theoretical value of 9.81 m/s^2.

Answer:

In science, the *theory* is what's being tested by the experiment. This (very common) response reverses that relationship.

Implications for public discourse of science

- 97% of actively publishing climate scientists agree that "climate-warming trends over the past century are extremely likely due to human activities" (J. Cook *et al*., 2016)

  - What does this mean?
  - That they're all appealing to the same authority?

Epistemic Beliefs

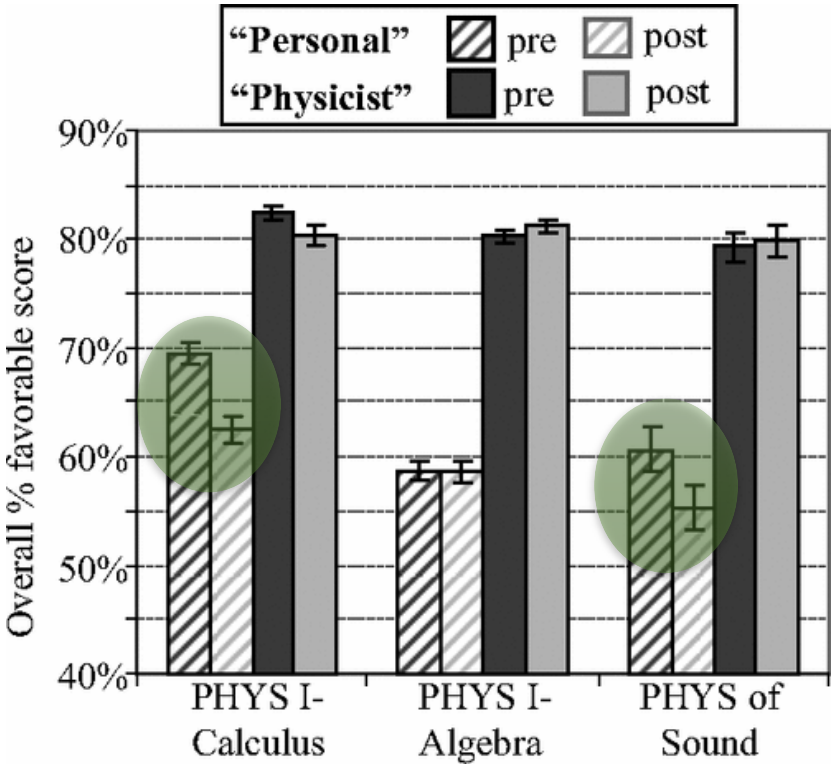
SAVOIR-ÊTRE

Learning involves adopting the practices, norms and warrants of a *community*.

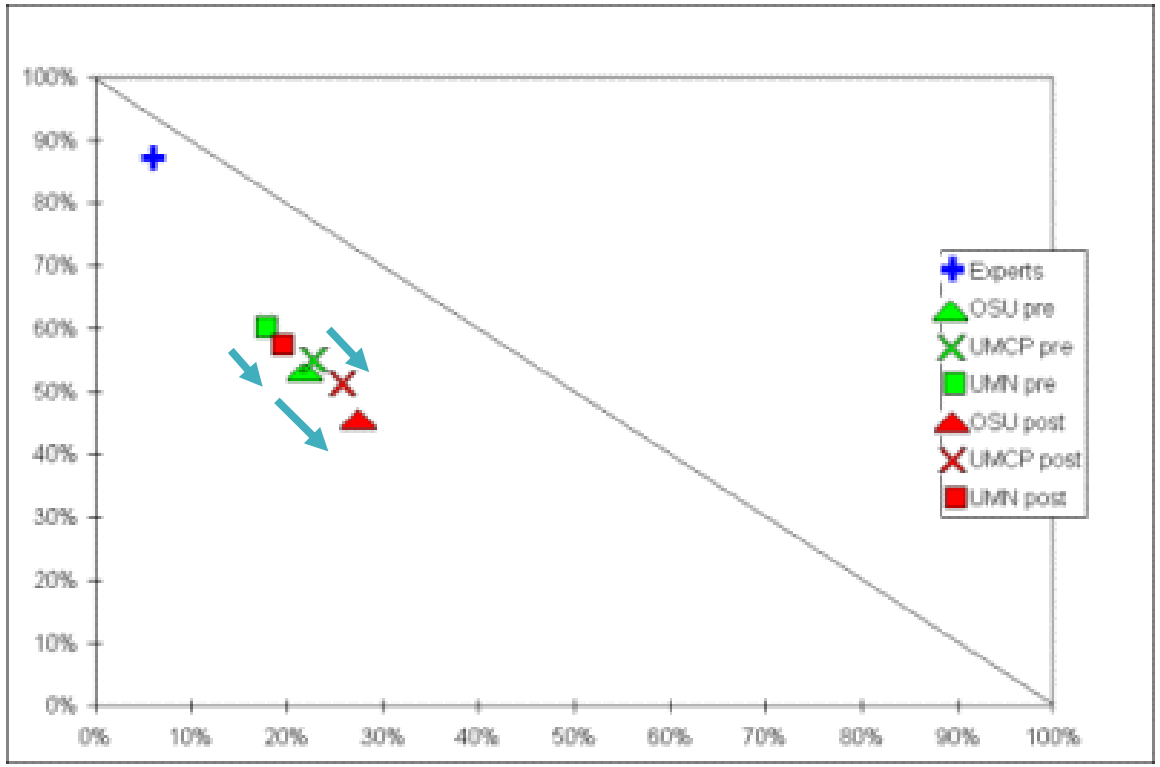
(Lave and Wenger, 1991; Brown, Collins and Duguid, 1989)

- Scientific community
- Engineering community

Instruction often has a negative impact on epistemic beliefs



CLASS attitude survey.
(Gray, Adams, Wieman, & Perkins, 2008)



MPEX attitude survey.
(Redish, Saul, & Steinberg, 1998)

"Among the most surprising findings in Physics Education Research is the lack of positive results on attitudinal measures, such as Colorado Learning Attitudes about Science Survey CLASS and Maryland Physics Expectations Survey MPEX ." (Brewe, Kramer & O'Brien; 2009)

Better understanding a community by examining its artifacts

- Journal Articles / Engineering Reports
- Implicitly encode the culture of the community
  - Structure of the document (Introduction, Materials and Methods, etc.)
  - Writing style (passive-voice, precise use of language, avoidance of personal pronouns)
  - Format of the document (e.g.: offset Abstract; Captions rather than Titles on figures)

Better reflect the norms and practices of the scientific and engineering communities...

by

... having students create lab reports that better reflect science journal articles and engineering reports.

Writing a lab report

- Understand research question(s)
- Organize data
- Compute uncertainties
- Calculate values
- Make tables
- Make graphs
- Make figures
- Critically analyze results and answer research question(s)
- Write *Introduction* (background, theory, research questions)
- Write *Materials and Methods*
- Incorporate, number and caption figures, graphs and equations
- Write *Data and Analysis*
- Write *Conclusions*
- Write *Abstract*

Constrained by timing

Total homework ponderation

Relative weight of lab component

(Approximate)

$$\left(3\,\frac{\text{hours}}{\text{week}}\right)\times\left(15\,\frac{\text{weeks}}{\text{semester}}\right)\times\ (15\text{–}20)\%\div\left(10\,\frac{\text{labs}}{\text{semester}}\right)$$

$$=40\text{–}54\ \frac{\text{minutes}}{\text{lab}}\ !$$

Introducing...

OCLaRE's Scaffolding Framework

- Partially pre-written reports
- Automatic generation of tables, graphs, etc.
- Constrained formatting report template
- Facilitates collaboration

Partially pre-written reports

- Students write new sections making explicit links to what's already written.
  - e.g., a student-written Conclusions section will make *explicit* reference to the research questions identified in a pre-written Introduction.

- Reduces time spent writing while emphasizing
  - the role of each section of the report
  - analysis and critical evaluation of the data

Automatic generation of tables, graphs, etc.

- Not every skill needs to be evaluated for each lab.
- Illustrates the important features of these elements (e.g.: error bars, best-fit lines).
- Reduces "busy-work" to place greater emphasis on exercising critical judgement.

Constrained formatting template

- Typeset, structured document (LaTeX)
- Table and graph templates
- Organization of the sections

Facilitated collaboration

- Multidisciplinary online platform
- Data shared within and between lab groups
- Individual or group report
- Teacher collaboration (sharing lab templates, activities)—harmonize programs of study across institutions.


OCL@RE
Student ID
Password
Lost your Password?
Login with Teacher ID?
Login
En Francais
Course List
List of Experiments
Experiment #1
Experiment #2
Ponderation
Due Date
Special Instructions
OCL@RE
Menu
Home
Course
Contact
Course List
Table # and Title
Description
Empty
+10,00mL
+20,00mL
+30,00mL
+40,00mL
+50,00mL
Average of each trial
Average of all three trials
Average of all three trials + standard deviation
Theoretical density value of dicholoromethane
% error
Trial 1
Trial 2
Trial 3
Mass flask (g)
Density (g/mL)
Table #: Observations

Current status

- Database model
- Login, group membership
- Markdown text input and storage
- LaTeX equation editor (math, physics and chemistry symbols)
- Consolidation of different elements to a final LaTeX document (pandoc)

In Progress

- Designing lab activities around OCLaRE pedagogy (partially complete)
- Programming lab activities into OCLaRE (summer 2017)
- Live pilot tests (Fall 2017)

Stagiaires!

Emmanuel –Abraham Léveillé-Rozan
Computer Science

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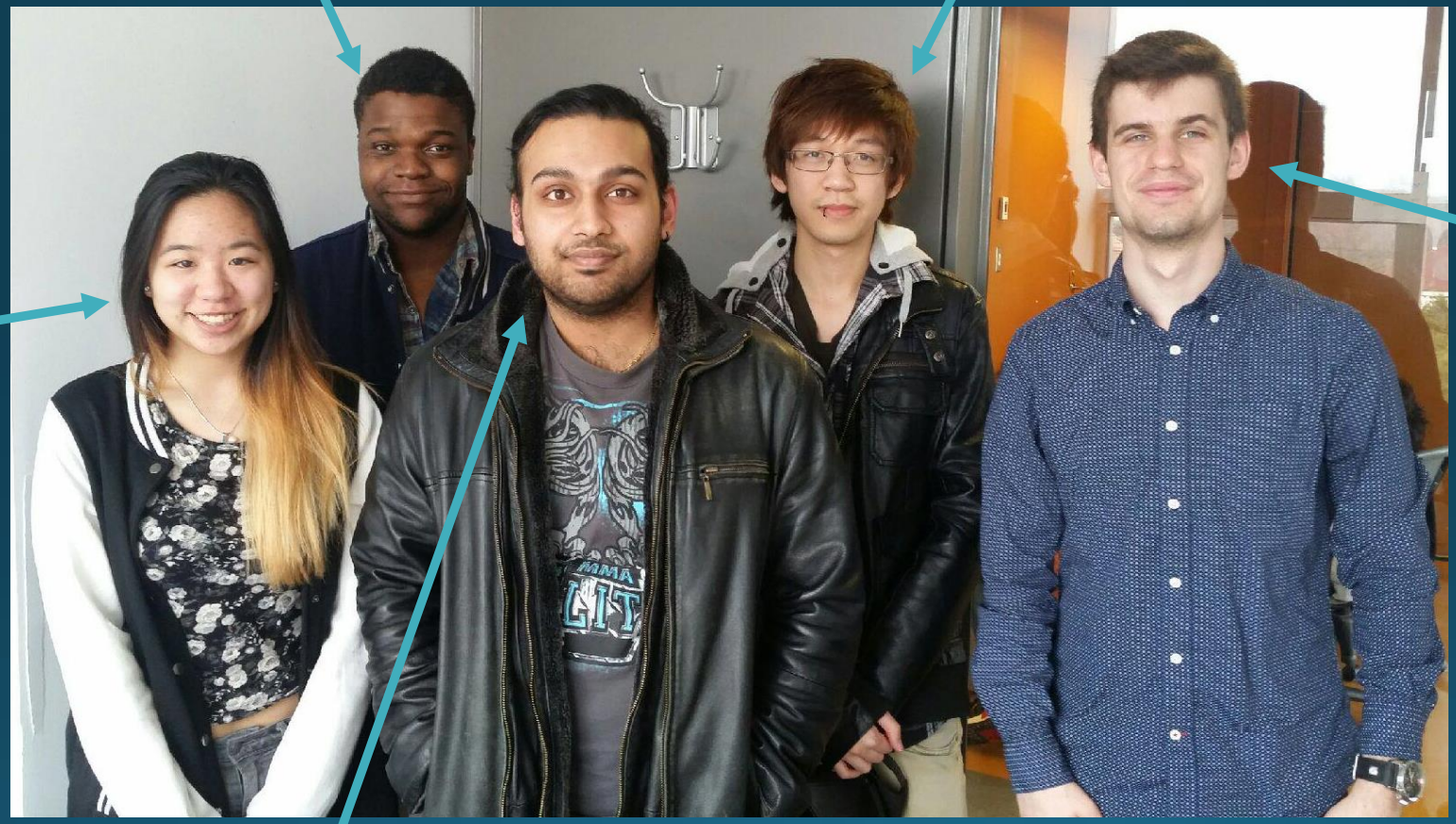
Graphics & Web Design



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- SALTISE (of course)

References

Science Program 200.B0 (MEES, 2016)

- Verify experimentally a number of laws and principles in (discipline)
  - Meticulous experimentation
  - Critical evaluation of results
  - Laboratory report in line with established standards

Introductory Physics Laboratory Goals (AAPT, 1998)

- The Art of Experimentation
- Experimental and Analytical Skills
- Conceptual Learning
- Understanding the Basis of Knowledge in Physics
- Developing Collaborative Learning Skills