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PhET INTERACTIVE SIMULATIONS
University of Colorado Boulder

Dashboard to Evaluate Student Engagement with PhET Simulations

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What information and visualizations should be presented in a dashboard for evaluating student engagement with PhET sims?

Introduction

The PhET project develops interactive simulations (sims) for science and math education.

Studies show a connection between the level and type of guidance used in an activity and student engagement with PhET sims[1-4]. Designing activities that strike the optimal balance for generating engagement and scaffolding for specific learning goals can be challenging.

How to help improve engagement?
Let's Evaluate it with a Dashboard!

Methodology

We follow the next dashboard design considerations[5].

Data sources: PhET-iO sims have been instrumented so that user-triggered events can be recorded in a data stream.

Indicators and metrics: In this research, engagement is correlated with the exploration of the sim: the duration, number, location, and evolution of clicks; and interactive elements used.
A survey of 146 teachers (53% High School, 29% College, 12% Teacher Education) about their interest in student data in a dashboard shows that 82% of teachers definitely or may use it, and 76.5% would use it after-the-fact.

Aggregated summary	Needed
Duration of use	44%
Rate of clicks/time	32%
Breakdown by screen	33%
Simulation states	69%
Features used	59%
Control settings tried	48%

Individual interaction	Needed
All clicks recorded	11%
Localization of objects	24%
Path of objects	19%
Controls used	48%
Simulation states	61%
Playback	24%

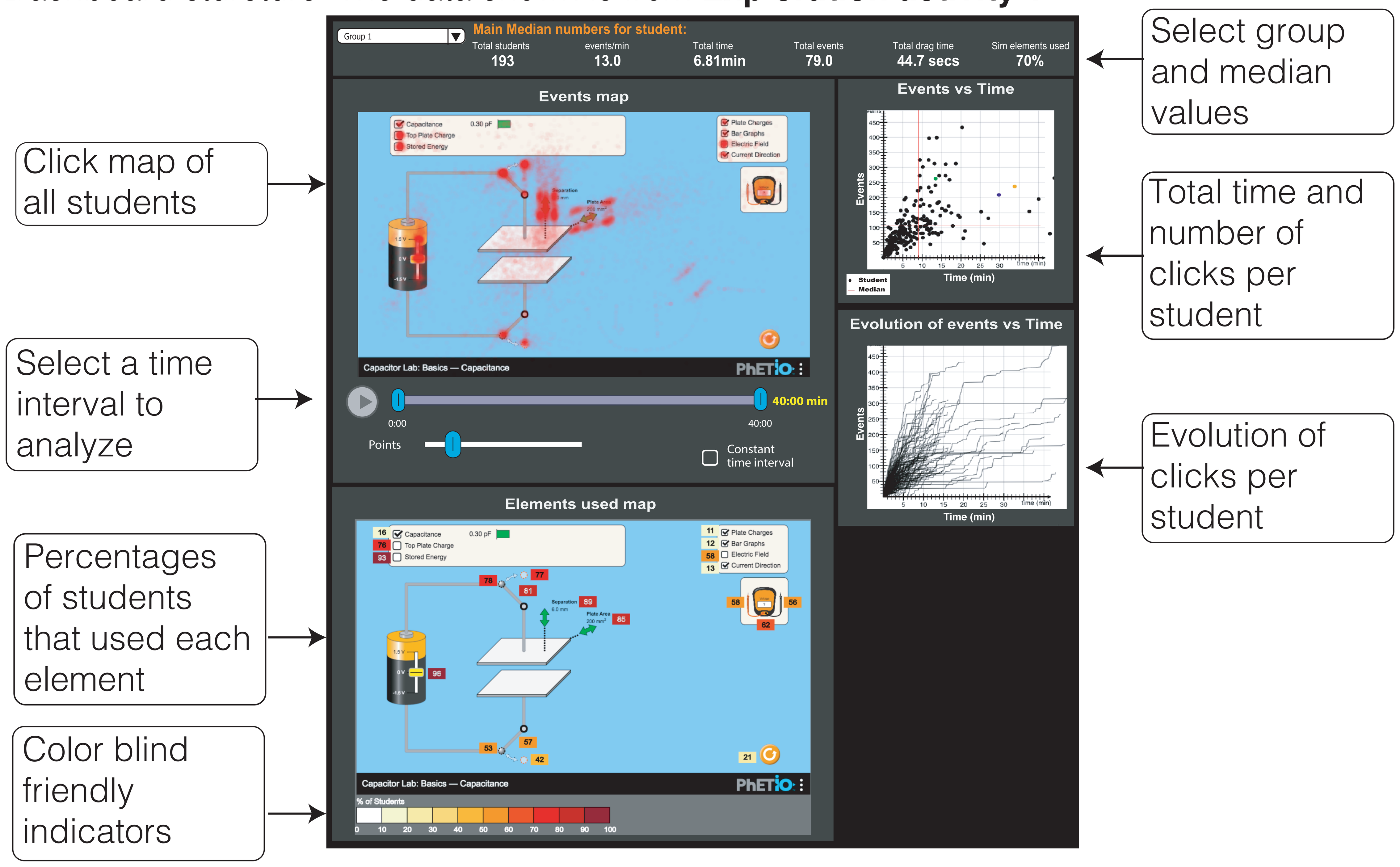
Design: Some visualizations were adapted from prior work [3,4] and Google Analytics.

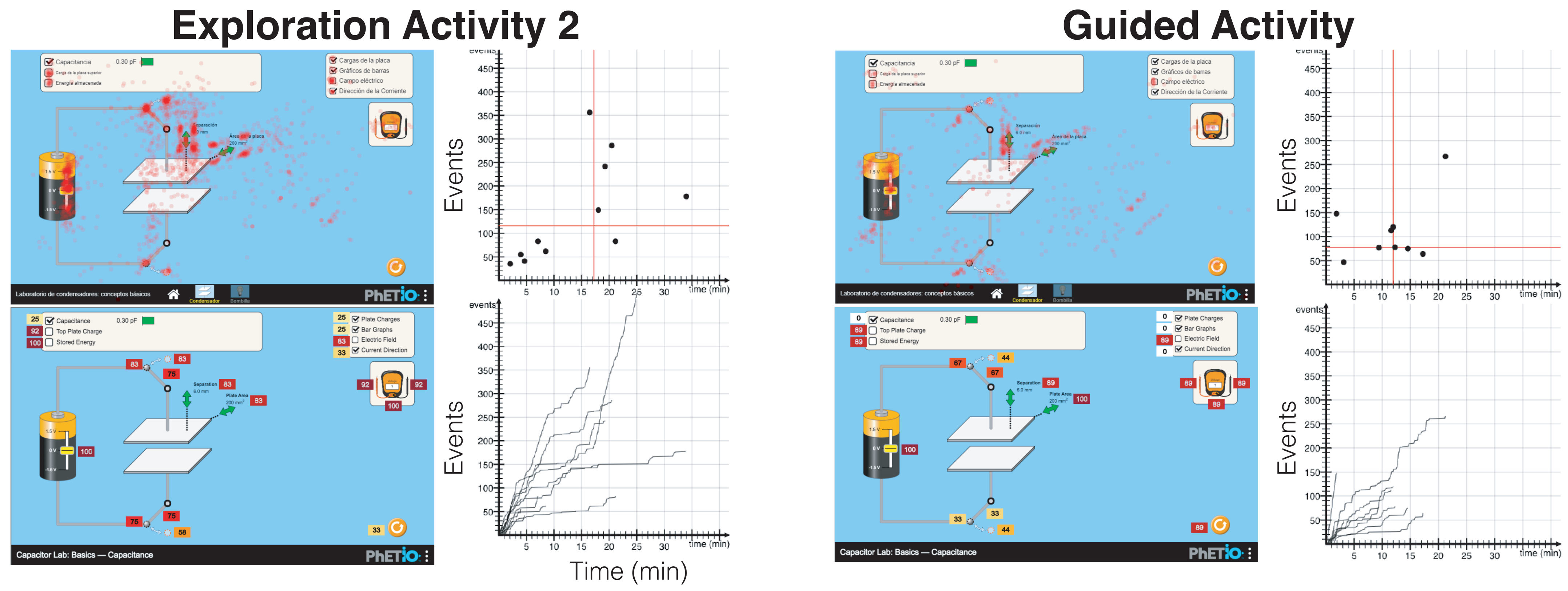
Test: Comparison of 3 homework activities for Capacitor Lab: Basics (examples)

Exploration activity 1: How does each factor affect stored energy in a capacitor?
Exploration activity 2: Activity 1 + voltmeter instruction
Guided activity: Slowly increase the battery voltage to 1.5 V. Observe changes in the stored energy.

Results

Dashboard sturcture. The data shown is from **Exploration activity 1.**





Conclusions and Future Work

The dashboard helps to describe the interaction patterns of students and can be an aid to improve activities. More data collections from other sims are planned to inform improvements in the dashboard design and visualizations. We are working on a third screen that allows comparisons of visualizations from different groups.

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