Visualizing Student Simulation Interactions: A Dashboard to Differentiate Between Instructional Approaches

Diana B. López Tavares[1], Katherine K. Perkins[2] and Michael Kauzmann[2]
[1] Instituto Politécnico Nacional, Mexico City, MX [2] University of Colorado Boulder, CO, USA
diana@cicata.edu.mx

Introduction

Instructional design and teacher facilitation are critical to support students in the development of conceptual learning and science practices using interactive simulations (sims). We examine the potential for a new tool – a **Teacher Dashboard for sims** – **to provide insights into student engagement that are useful for informing activity design, comparison, and improvement.**

Methodology

Data collection of student-sim interaction from a homework activity using two different instructional approaches:

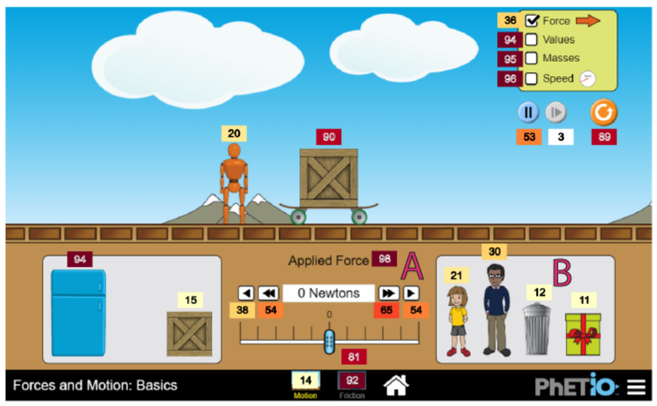
Guided Activity: specific direction about how to control the sim followed by conceptual questions. Example: "Apply a constant force to the box for a few seconds. What happened to the speed?"

Challenge Activity: poses challenges without telling students how to accomplish them in the sim. Example: "Find and describe a situation where the speed decreases."

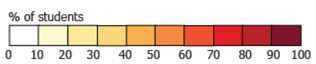
A teacher dashboard for sims helps characterize student interaction with sims and meaningfully differentiate student interaction in activities.

Data from Guided Activity

Elements used map



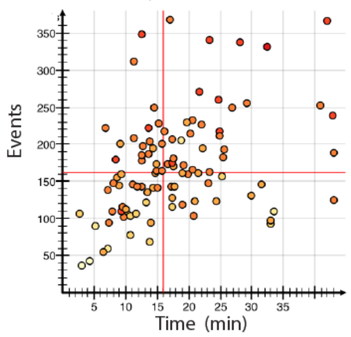
% of students



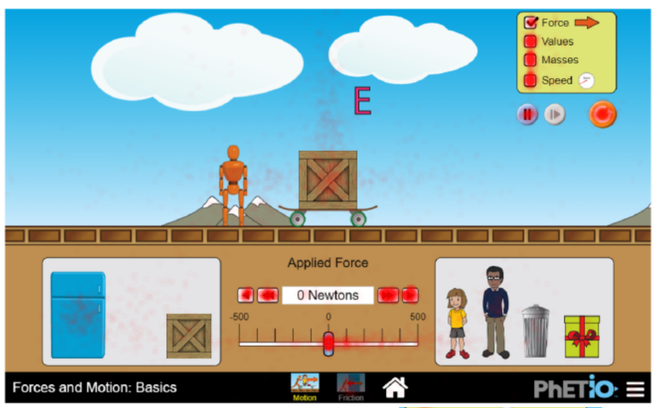
Median values C

Events/min	Total time (min)	Total events	Elements used
10.3	17.4	171	50%

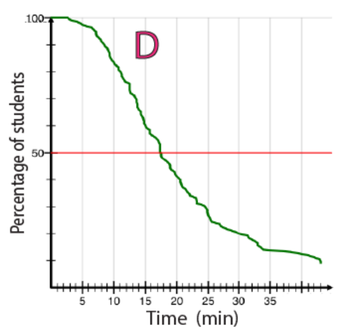
Total Events, Time and Elements



Evetns map

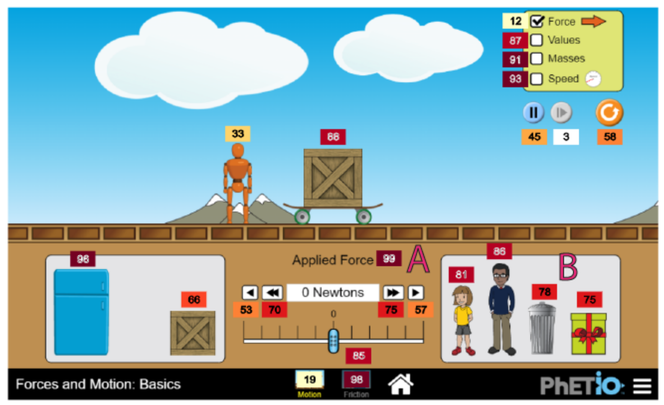


% Students vs time

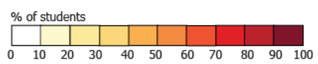


Data from Challenge Activity

Elements used map



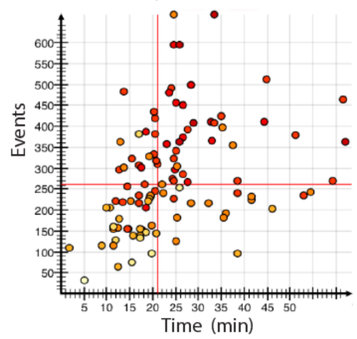
% of students



Median values C

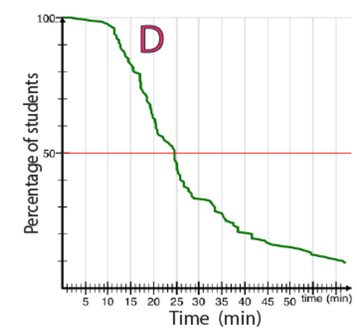
Events/min	Total time (min)	Total events	Elements used
11.9	24.6	273	63%

Total Events, Time and Elements



Evetns map

% Students vs time



Comparison: In the Challenge activity students...

- **A** used more buttons to change the force.
- **B** moved more other sim elements.
- **C** used the sim longer and interact more.
- **D** interacted for more than 10 minutes.
- **E** interacted more in the play area.
- **F** increased more the friction value.

Acknowledgements

The authors are grateful to all the students that participated, and to the PhET team for their support. This work was funded by the Gordon and Betty Moore Foundation as well as the CONACYT and CICATA-IPN (Mexico).

References

[1] E. B. Moore, T. A. Herzog, and K. K. Perkins, Chem. Educ. Res. Pr. 14, 257 (2013).
[2] B. A. Schwendimann, et al., IEEE Trans. Learn. Technol. 10, 148 (2017).
[3] T. Käser, N. R. Hallinen, and D. L. Schwartz, in Proc. Seventh Int. Learn. Anal. Knowl. Conf. - LAK '17 (2017), pp. 31–40.
[4] A. Borek, et al., in Proc. Fourth Eur. Conf. Technol. Enhanc. Learn. Learn. Ing Synerg. Mult. Discip. (EC-TEL 2009), pp. 391–404.

PERC Paper

Dashboard Prototype