



# Teaching to Learn: Using iPads to Transform Science Student Roles



Susie Nicholson-Dykstra, Ben Van Dusen & Valerie Otero.

Northglenn High School • University of Colorado at Boulder • School of Education • Boulder, Colorado.

## Research Questions

### 1) What impact does a 1:1 iPad environment have on student learning?

- Engagement, Confidence & Agency
- Achievement / Content Understanding
- Identity as Scientist and Engineer
- Communication of Scientific Ideas



### 2) How can a 1:1 iPad environment be used to transform students into Learning Assistants (LAs), researchers and independent thinkers?

## Student Population

- **Urban public high school**
- **Courses Impacted:** (~150 students)
  - AP Physics
  - General Biology
  - Biomedical Sciences
- **Demographics:**
  - Ethnicities:
    - 57% Hispanic/Latino, 33% Caucasian, 2.7% African American, 4.8% Asian, 0.5% Native American
  - Free and Reduced Lunch: >35%
  - English Language Learners: >27%



## iPads: Develop a Personalized Experience

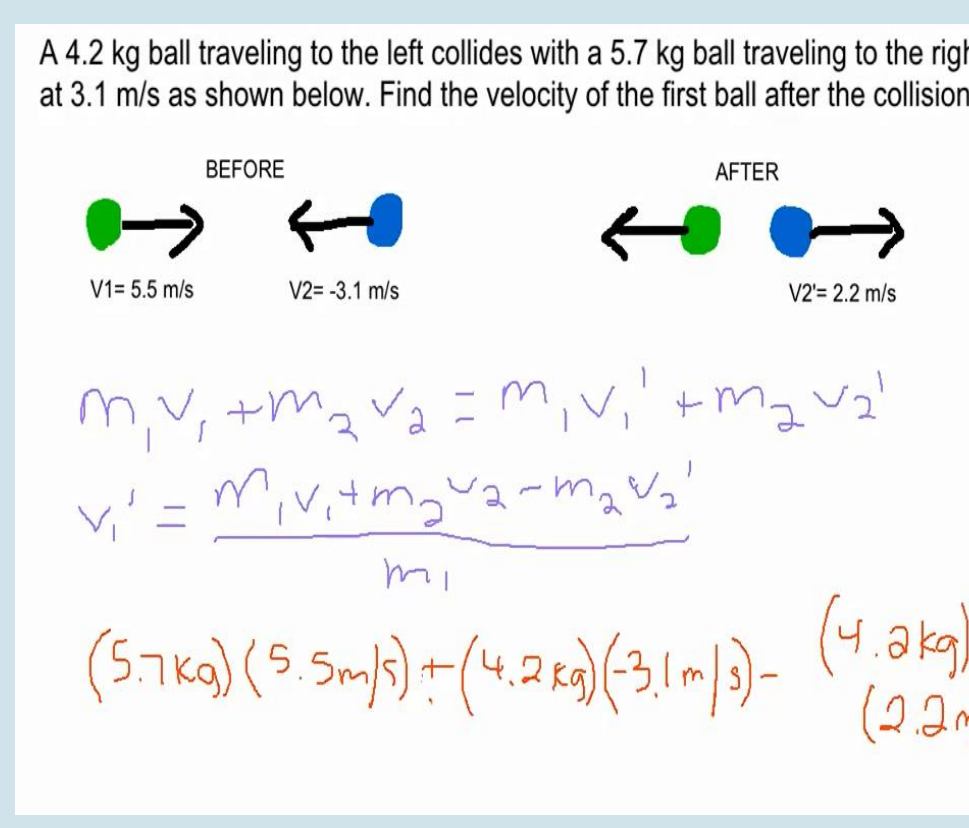

Surveys of students in all 5 courses indicate that they believe iPads personalize their learning experience and help them to learn science

Student Survey Data	% students who agree (n=102)
<b>iPads allow me to:</b>	
• Work independently	76%
• Work at my own pace	73.5%
• Research my own questions	77.5%
• Be more creative in my work	66.7%
• Communicate more with my teacher (via Edmodo)	10%
<b>iPads make learning more fun &amp; engaging</b>	<b>68%</b>
<b>iPads help me to learn science...</b>	<b>71.5%</b>
• By providing access to resources (internet, apps, tools) and allowing me to be the researcher	44%*
• By supporting my personal learning needs (pace, type of activity, ease of use)	49%*
<b>I modify (personalize) my iPad in at least one way to meet my needs &amp; preferences</b>	<b>98%</b>

\* % of explanations of why students enjoyed using iPads and found them helpful for learning science

## iPads: Developing Asynchronous Learning Assistant (LA) Experiences

Students in AP Physics were asked to create "Screencasts" (digital tutorials, Pencasts) to teach peers how to work through sample problems and model content understanding. By voice- and screen-recording tutorials, students can asynchronously mentor their peers.

Teaching Tool	App	Student Samples
<b>Screencast</b> 	<ul style="list-style-type: none"> <li>• Explain Everything*</li> <li>• Screen Chomp</li> <li>• ShowMe</li> <li>• ReplayNote</li> <li>• Educreations (*=preferred app)</li> </ul>	<ul style="list-style-type: none"> <li>• Kinematics</li> <li>• Systems of Forces</li> </ul> 

### Student Testimony:

"Screencasts are very helpful, because, for one, they force the creator to learn the problem they will be presenting in such depth that they can adequately teach it to others. With regular homework, it seems only a basic understanding is necessary, sometimes. I was able to really grasp the concepts I was teaching, which helped in future projects. I highly recommend this to future AP students, because it is very beneficial to the creator. Plus, if you don't understand something, someone else may have posted a screencast on the very topic!"

## Reasons Students Believe Screencasts are Valuable (n=24)

Teaching to Learn: Learn by creating a lesson for peers	62.5%
Learning from Peers: Watch video to learn how others process a question	33.3%
Evaluate Understanding: Allows teacher and student to monitor progress	12.5%
Practice Communicating Science	12.5%

(Note: Values do not add to 100% because some comments included more than one explanation)

## Ways that Screencasts Differ from Traditional Homework (n=24)

Screencasts require greater depth of understanding	20%
Traditional homework requires greater breadth of understanding	10%
Screencasts impose a different level of accountability & motivation for understanding & completing work	20%
Screencasts require teaching the process	25%
Screencasts allow audience to learn the process	15%
Making and watching screencasts is multisensory	10%
Screencasts provide more creative expression	35%
More intimidating to seek help for screencasts	10%
No significant differences	10%

(Note: Values do not add to 100% because some comments included more than one explanation)

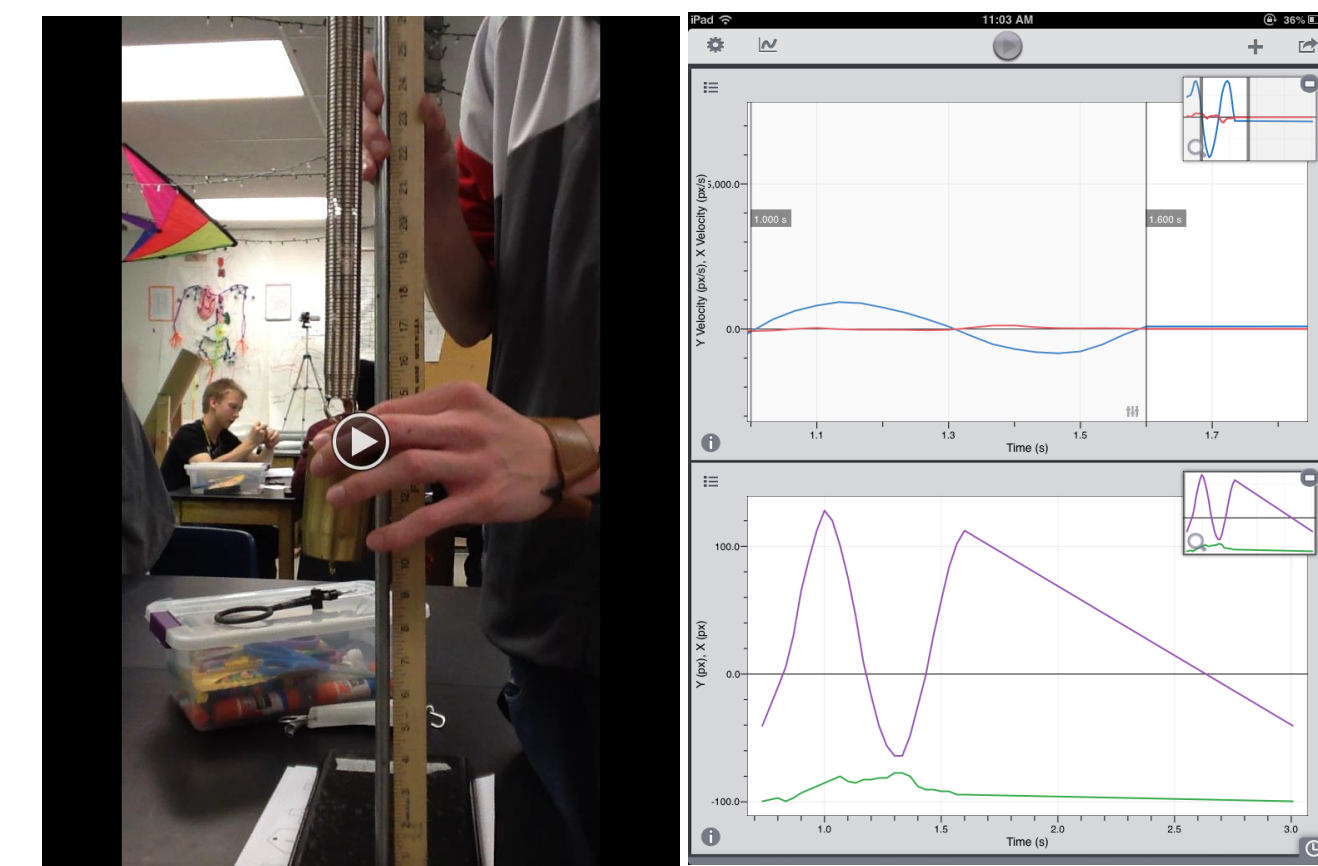
## iPads: Developing Scientists

Student survey data from all 5 classes indicate that students believe iPads help them to research information (on the internet), and seek answers to their own questions. With the transition to Next Generation Science Standards, iPads provide a valuable tool for empowering our students as independent researchers, helping to build agency in students of all levels and abilities.

### Student Testimony:

"I am definitely more curious about how the world works, and I use more technology to help myself discover/learn."

- Student survey data from all 5 indicate that students believe iPads help them to research information (on the internet)
- AP physics students independently chose to apply their iPad camera & the Vernier Video Physics App as a tool for collecting and analyzing data in ALL major labs of the year (without prompting from instructor)
  - Use of same tool for observing and analyzing different types of physical phenomena indicated that students were identifying cross-cutting concepts and relationships across content units
- 4 of 6 AP physics students interviewed at the end of the school year indicated that the iPad and the Vernier Video Physics App were, together, two of their most valuable and important physics tools



## Future Work

- Develop NGSS-aligned rubrics to monitor student growth in skills of scientists/researchers through use of iPad
- Measure student growth in content achievement when screencasts are included in the learning pathway compared to traditional activities
- Work with students to brainstorm ways to make screencasts easier to complete
- Work with students to build accessible collection of problem- and standards-aligned screencasts

## Acknowledgements

We would like to thank the Streamline to Mastery Program and amazing peers, Kathy Hulbert & Sue Lord, for continual support, feedback and assistance with this project. This project was funded by NSF grant # DUE 934921 and Northglenn High School, Adams 12 Five Star Schools.