The Design, Application and Evaluation of a Gamified Virtual Laboratory to Aid in Distance Learning - Chemistry Education

Tauber, Amanda L; Schweiker, Stephanie S; Levonis, Stephan M

The Design, Application and Evaluation of a Gamified Virtual Laboratory to Aid in Distance Learning

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Amanda Tauber*, Stephan Levonis and Stephanie Schweiker

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We acknowledge the Kombumerri clan of the Yugambeh language group as the traditional custodians of this land.

We pay respect to their Elders – past and present for their wisdom, teaching and cultural knowledge.

Artwork *by* Narelle Urquhart 2018

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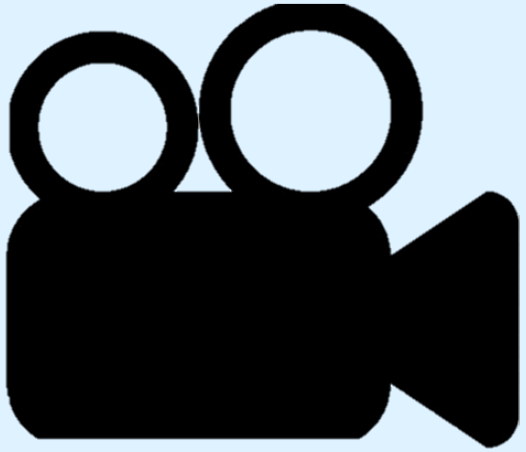
Live-record the lab



Pre-record the lab

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360° Virtual Laboratory Tour with Embedded Skills Videos

Stephan M. Levonis*, Amanda L. Tauber, and Stephanie S. Schweiker

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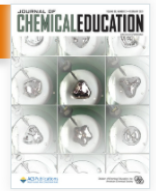
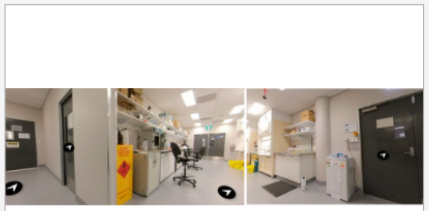


Journal of Chemical Education

PDF (4 MB) | Supporting Info (2) » | **SUBJECTS:** High-performance liquid chromatography,

Abstract

This paper describes the design and effectiveness of a 360° (identified as 360) virtual laboratory tour which was implemented in a second-year undergraduate chemistry subject to familiarize the students with the research laboratory environment, equipment, and skills needed to undertake the subject and first laboratory session. We include step by step guides on how to produce a virtual laboratory tour using freeware and on how to produce and incorporate interactive videos into the tour. The virtual laboratory tour that we developed was given to the students prior to their first laboratory class and was well-received by students with 100% of students surveyed reporting that it was an effective learning aid. Virtual laboratory tours offer a promising option for creating a personalized online laboratory experience.



FUTURE MEDICINAL CHEMISTRY, VOL. 12, NO. 14 | EDITORIAL

Free Access

Figures References Related Det

A quick guide to producing a virtual chemistry course for online education

Stephanie S Schweiker & Stephan M Levonis

Published Online: 9 Jun 2020 | https://doi.org/10.4155/fmc-2020-0103

Sections View Article Tools Share

Keywords: blended learning • lightboard • virtual • virtual classrooms • voice-over powerpoint

With current educational climates and technological advances, it is possible to deliver an integrated, personalized and engaging chemistry subject through online platforms. The current generation of students have emerged with pre-existing experience of the internet, tablets, smartphones, and computers and generally embrace the inclusion of technology in their education. The ample available software platforms available for blending the student experience and enhancing their deeper learning can be divided into four sections: the augmented laboratory, voice-over presentation, lightboard with augmented reality and virtual classrooms. In this Editorial, we will focus on these four main areas and discuss the common software that can be

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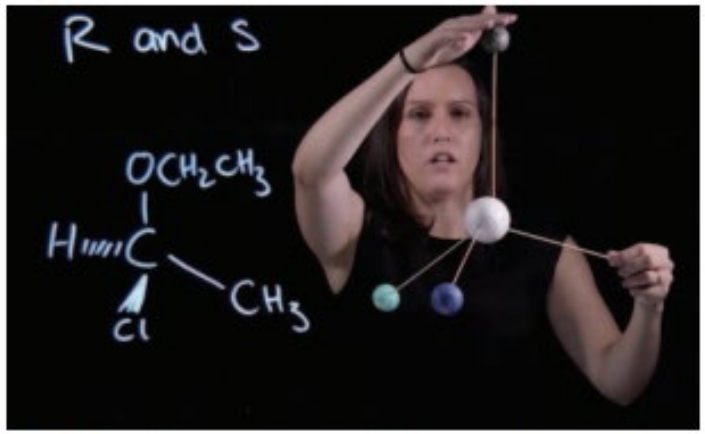
Lightboard videos



With higher education now being delivered in either multi-

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Virtual Laboratories

Opportunity

- Laboratory introduction
- Theoretical focus
- Engagement

Challenges

- Hands-on
- Equal access
- Engagement

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Purpose

Introduce both on-campus and remote student to the laboratory

Ensure that both groups are provided an equal and fair learning experience.

Tackle the retention and comprehension difficulties students express in regards to labs

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Proposal

Incorporate feedback

Virtual Lab V1
Aspirin Synthesis
Week 4-6

Virtual Lab V2
Transition Metal
Week 10

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Student Population

Enrolled in BMED12-119 Biological and Physical Chemistry

Third semester Biomedical Science and health Science students

Compulsory laboratory for all students (n = 49)

Optional recruitment to interact in feedback surveys (n = 30) ~61%

Aim

Design a virtual laboratory for both on-campus and remote students that was useful and engaging.

Tech Smith Camtasia

360 degree lab tour

Video Design

- Plan out stations
- Film the experiments
- Edit and add gamification to videos

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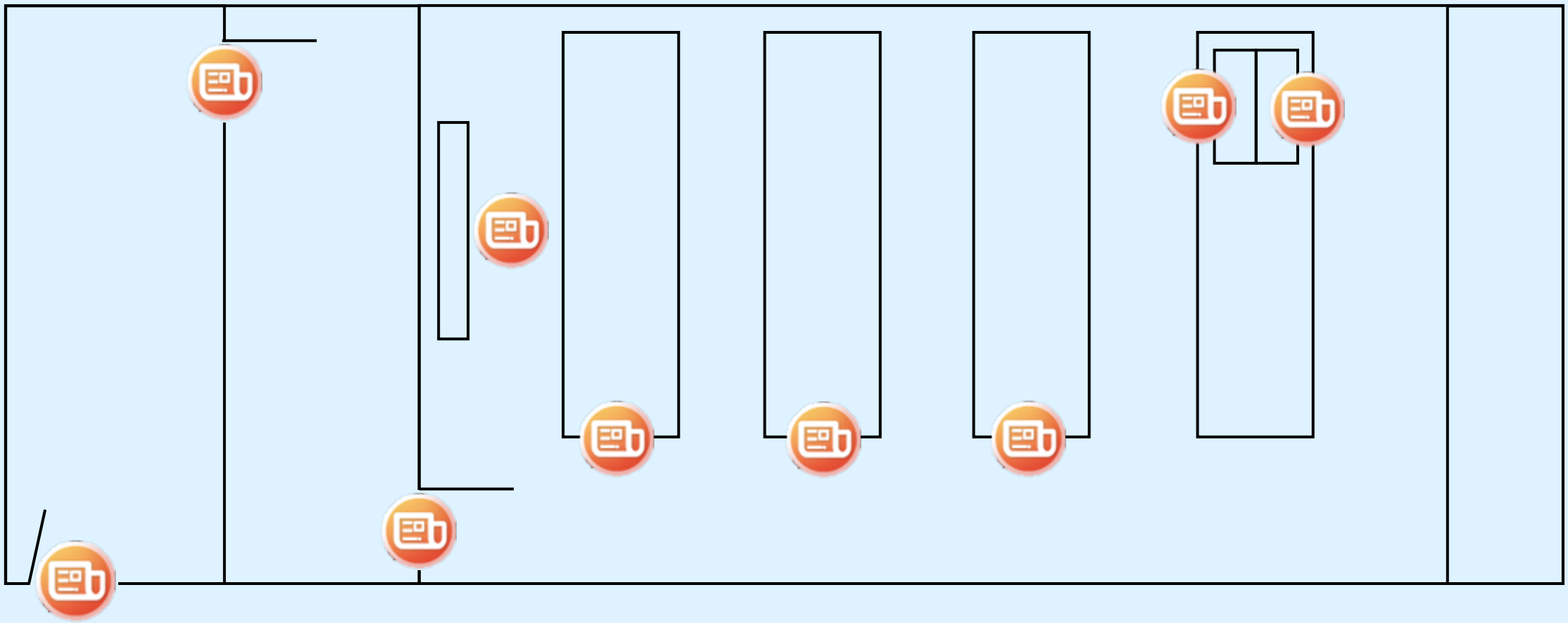
Stations and Filming



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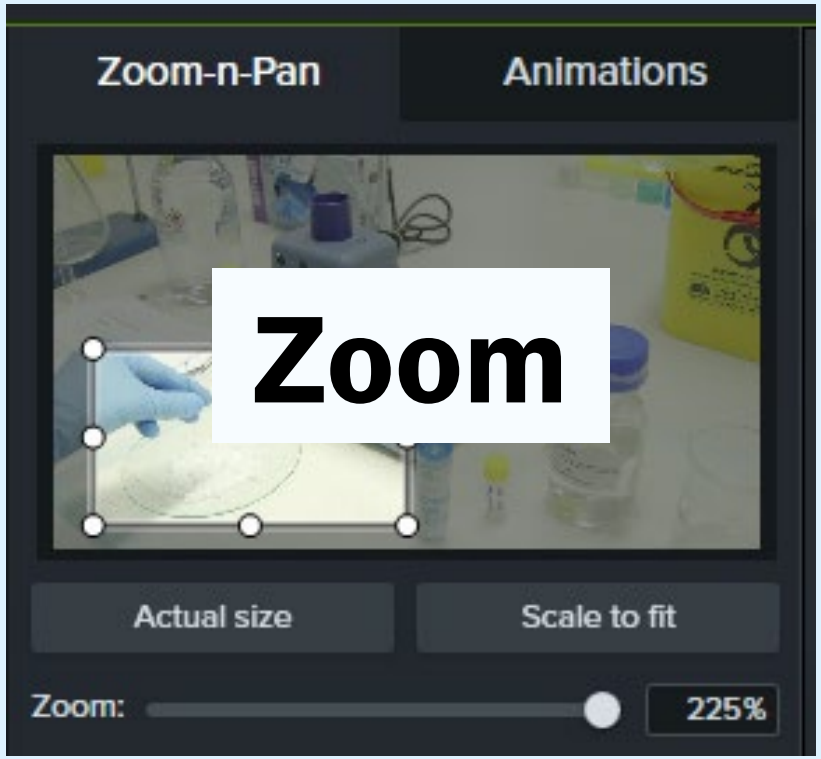
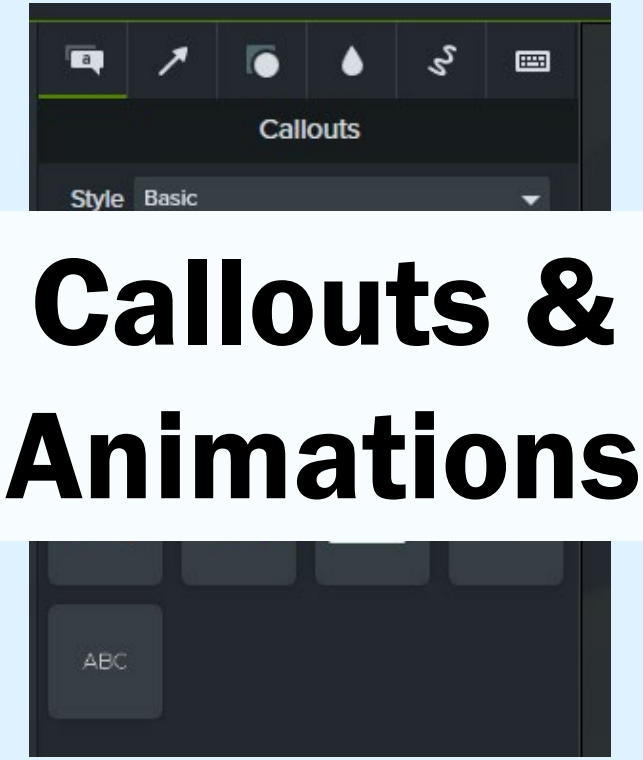
Video Design

- Plan out stations
- Film the experiments
- **Edit and add gamification to videos**

Video Design



Zoom



Callouts & Animations

Embedded Quiz

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Video Design

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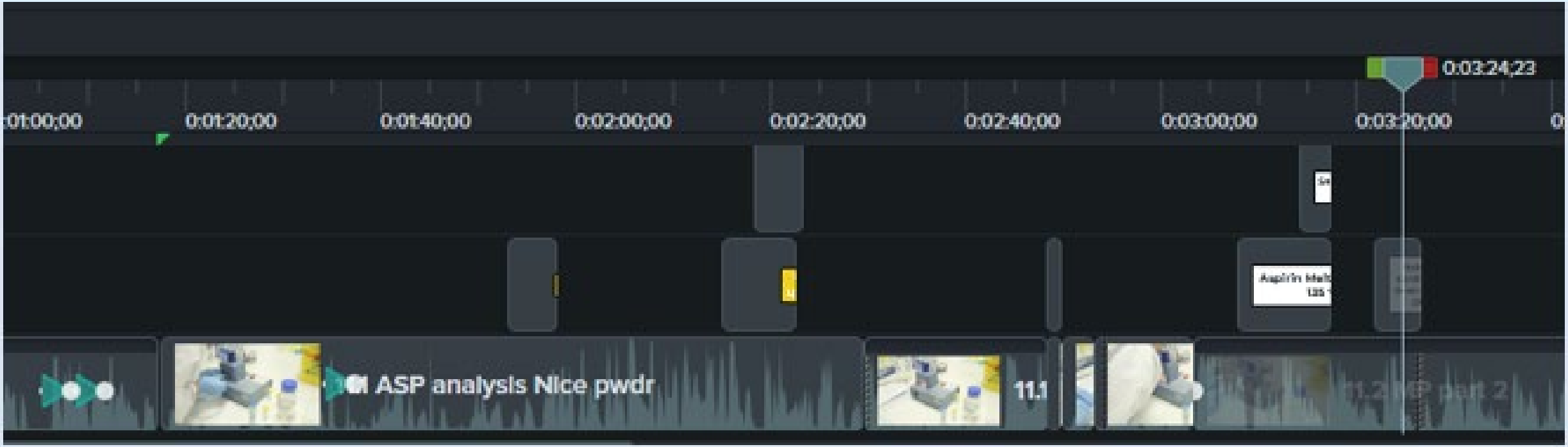
Zoom

Video Design



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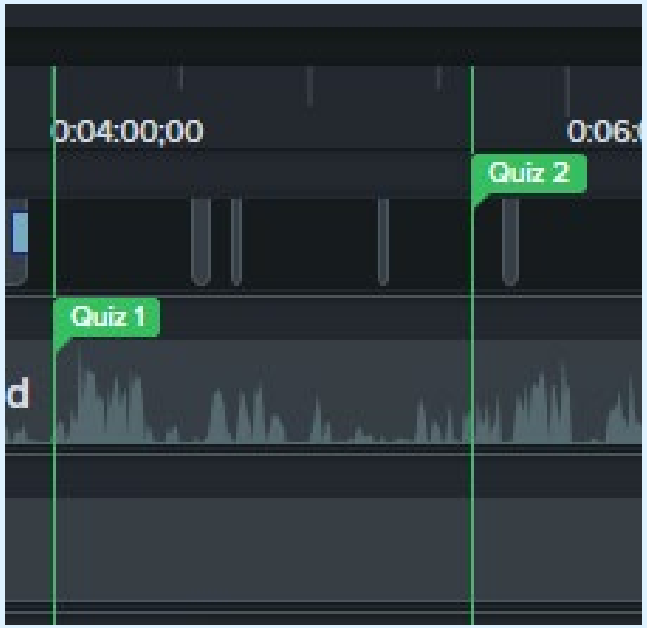
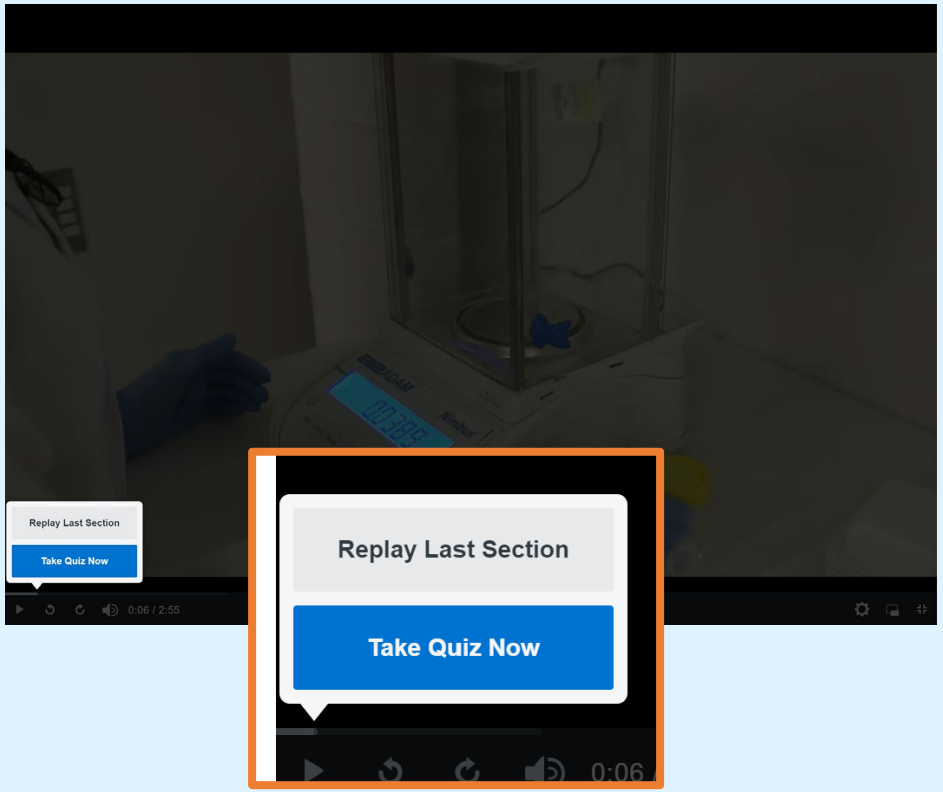
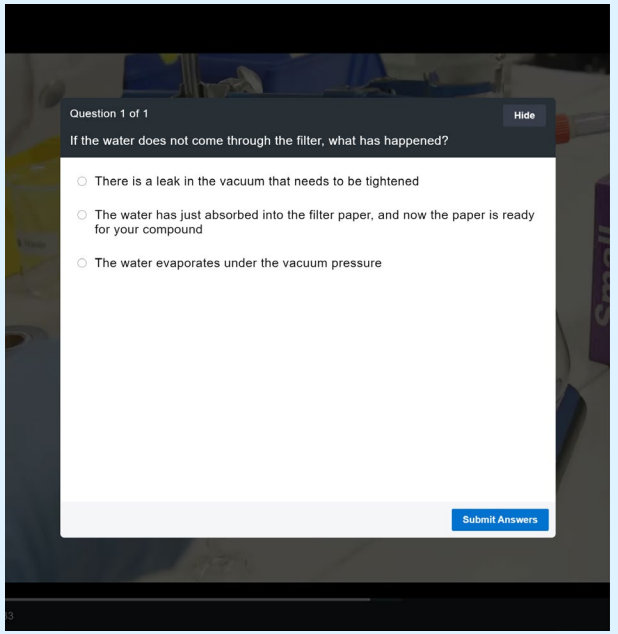
Callouts

Video Design







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Quizzes

360 degree tour

- Differentiate video icons...
- from “fun facts” information markers
- Use single direction links between the spaces

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360 degree tour

- Differentiate video icons…
- from “fun facts” information markers
- Use single direction links between the spaces

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Delivery

- Released as a pre-lab tour for on campus students
- To be the complete lab for remote students
- Follow the lab, another full-tracking version was released to both groups for revision

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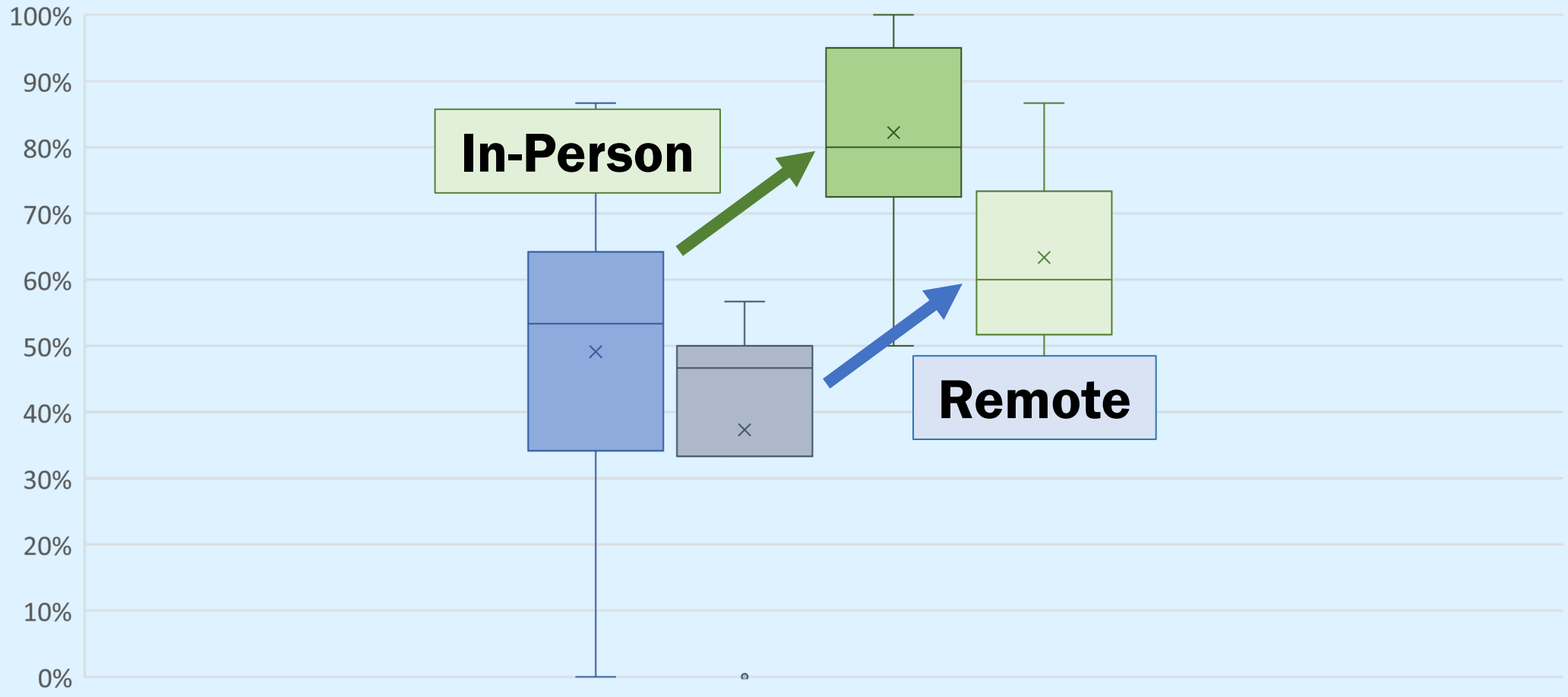
https://app.lapentor.com/sphere/aspirin-lab-1-synthesis

Performance



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Box and whisker plot comparison of the pre- and post-laboratory quiz from both the traditional and the virtual group. Light blue = Pre-laboratory traditional group (n = 22), Dark blue = Pre-laboratory virtual group (n = 3), Dark green = post-laboratory traditional group (n = 18), light green = post-laboratory virtual group (n = 3).

Feedback

Do you think the (pre-laboratory) virtual laboratory resource was an effective learning aid?

100%

Feedback

“It really felt like I was in the lab myself but instead had a supervisor walking me through all the steps.”

I felt the self-paced, quiet nature, and step-by-step instruction of the virtual laboratory meant I understood the process much better than I would if I were in a traditional laboratory with several others competing for attention

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Feedback

Not that it was bad, but opening and closing the door isn't really necessary but it doesn't bother me too much (just if I had to choose something) - I think this is a great step for online people though

Could have just been a video like little bit less interactive

Being able to go back over parts that I was unsure of.

Incorporation (V2!)

- Understanding the process
- Content revision
- Enabled tracking

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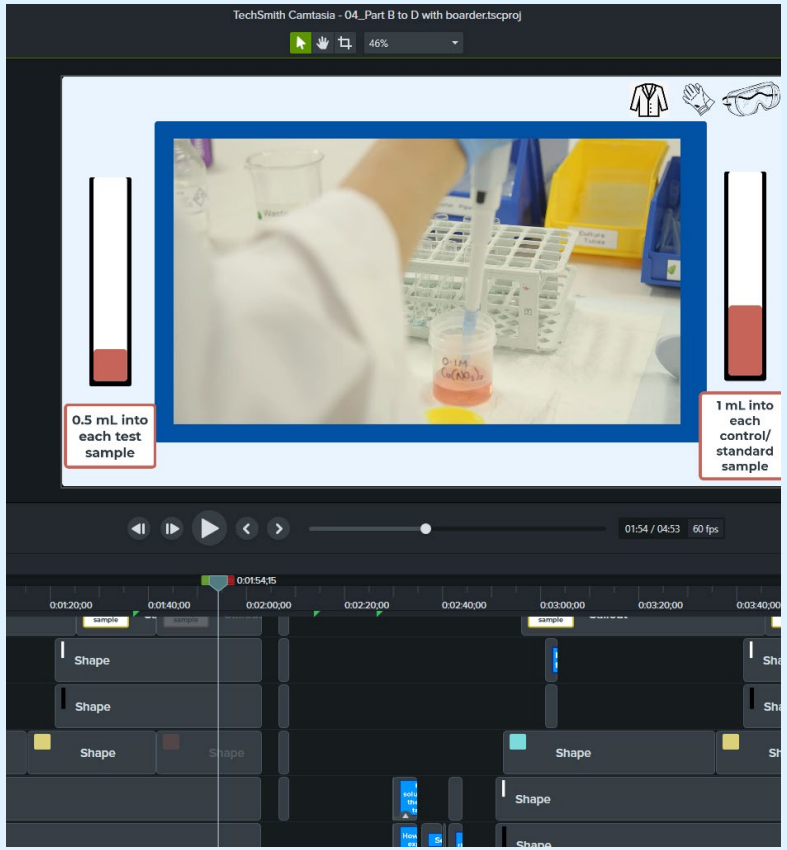
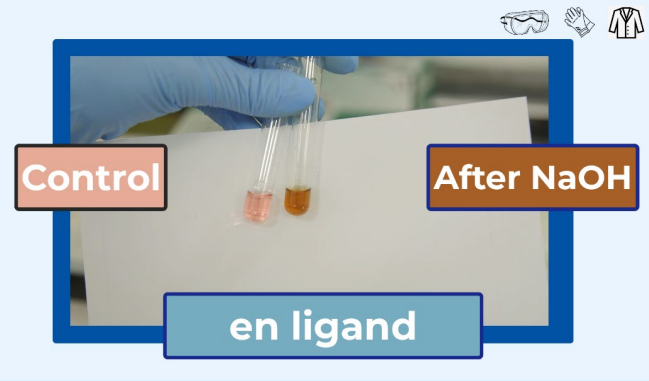
Incorporation (V2!)

- **Understanding the process**
- Content revision
- Enabled tracking





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Incorporation (V2!)

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Incorporation (V2!)

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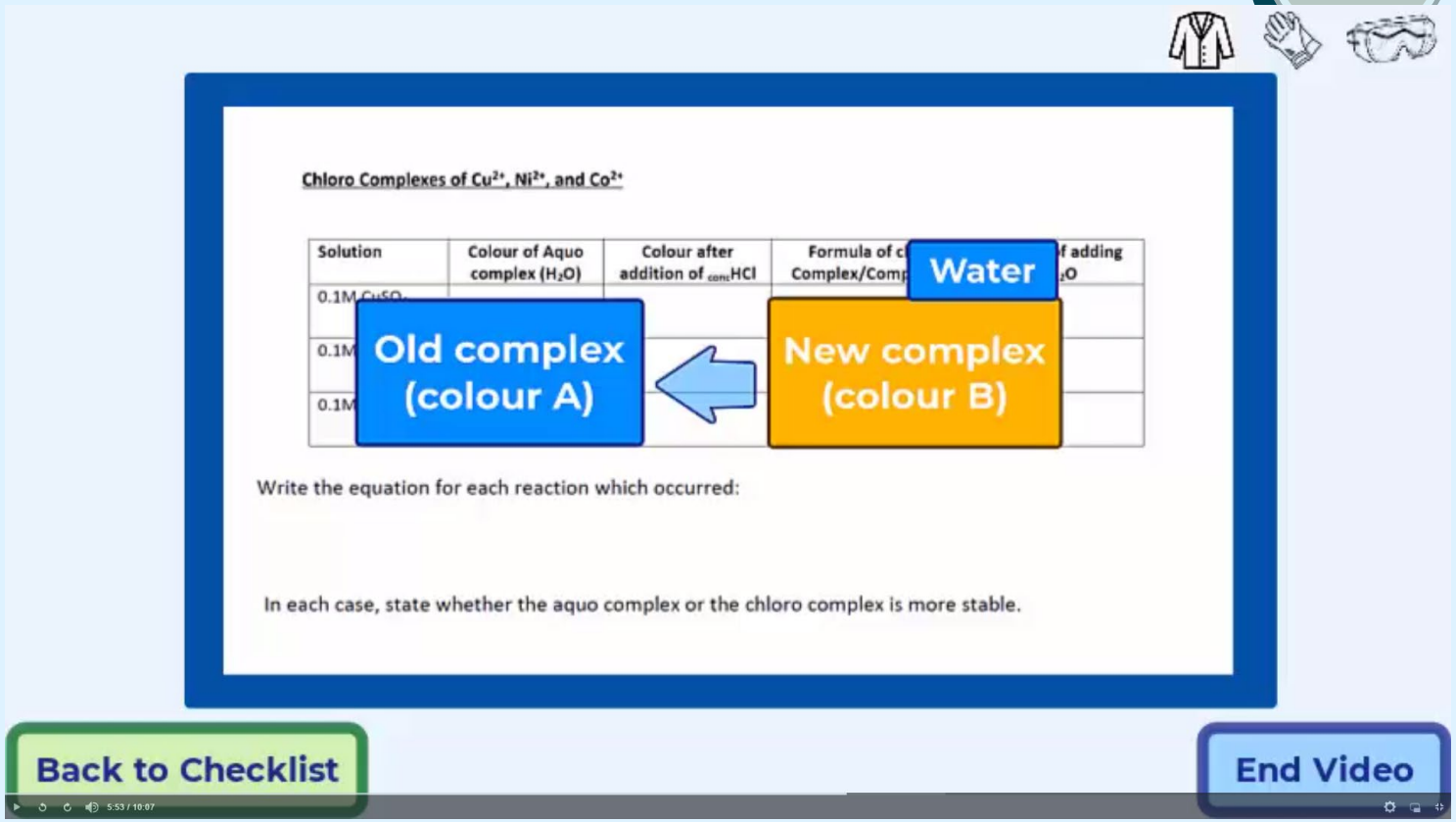

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Incorporation (V2!)

- Understanding the process
- **Content revision**
- **Enabled tracking**

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Feedback

"It gives extra theory that was useful for assessments and understanding:"

"that you could move easily through the lab with the bar on the side"

Takeaway

Virtual laboratories can be useful tool for both in person and remote students

After an initial time-investment, modifications are easy and quick to adjust

Although it cannot replicate the hand-on experience, it provides an alternative but appreciated learning tool

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Thank you!

Stephan Levonis

Me

Stephanie Schweiker

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https://app.lapentor.com/sphere/aspirin-lab-1-synthesis