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## Does "Significant Difference" Hold True? Comparing Student Performance in Online vs. Traditional Science Courses

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# DOES “NO SIGNIFICANT DIFFERENCE” HOLD TRUE?

Comparing Student Performance in Online vs. Traditional Science Courses

Presenters: Emily Faulconer & John Griffith

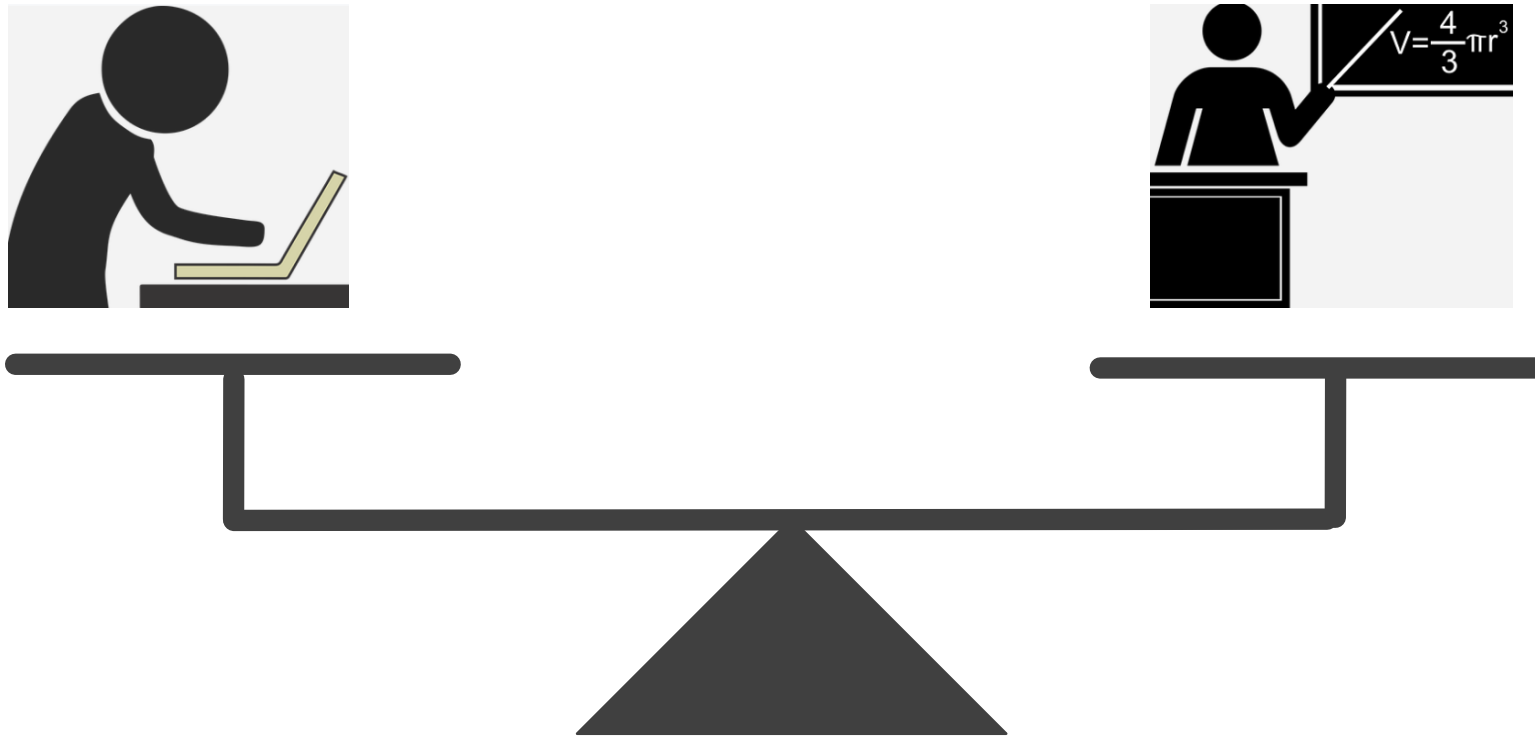
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Donna Roberts

**EMBRY-RIDDLE**  
Aeronautical University  
WORLDWIDE

Meta-analysis studies comparing student outcomes in online and traditional courses indicate **no significant difference** (or a slight improvement in online courses)



**online course offerings are rising**

Multiple studies show students are less likely to persist in online courses ... which is a concern for underprepared students



- ✓ **Social**
- ✓ **Technical**
- ✓ **Cognitive**

### **Social Support Theory**

(Bawa 2016, Wilcox, Winn, & Fyvia-Gauld 2005, Metz 2002)

Unclear if significant differences exist when asking more specific questions:

- Individual science disciplines: Chemistry & Physics
- Format of “online” modality
- Science labs



# Study Context:

## University

- Ranked #1 in Online Bachelor's Programs for the last 2 years
- 85% non-traditional modalities and 15% traditional lecture

## Participants: Nontraditional Students

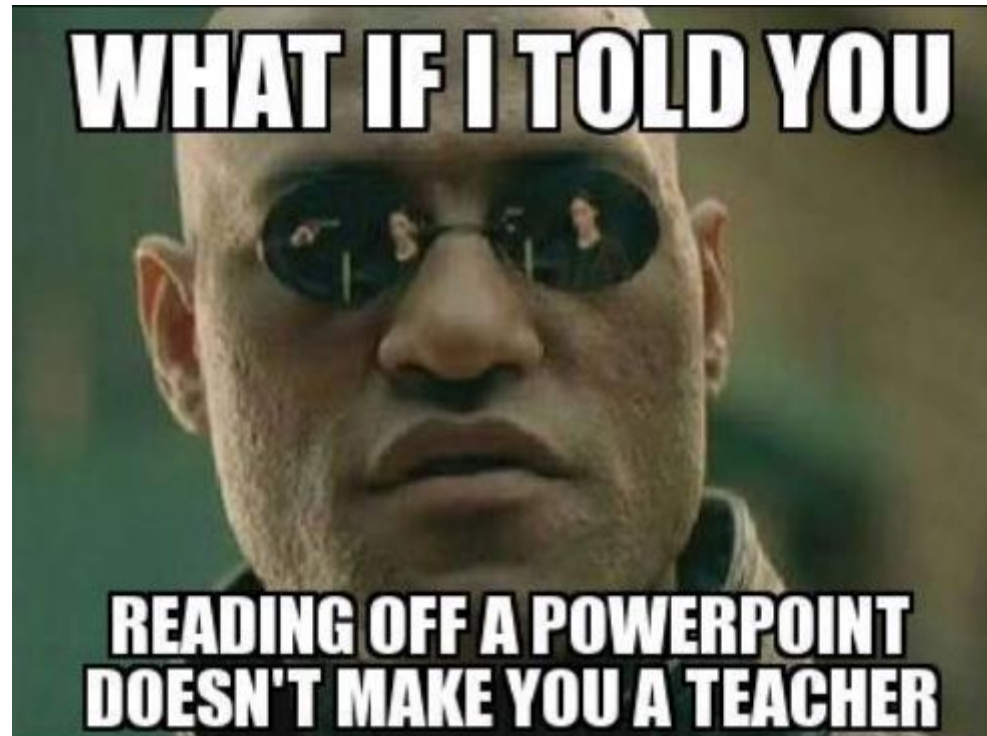
- Physics Data: 1,964 enrollments for 15-16 AY
- Chemistry Data: 823 enrollments for 15-16 and 16-17 AYs

## Course Formats:

- Traditional classroom
- Asynchronous online
- Synchronous video – classroom
- Synchronous video – home

## Moderating Factor: Instructor

- Skill – same training
- Cannot control pedagogical methods employed
  - Lou et al 2006 pedagogy variations explain significant amount of variation in outcomes for distance ed

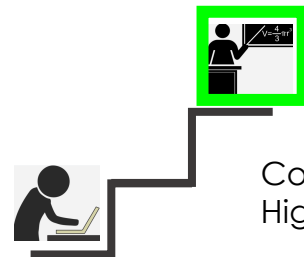
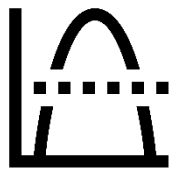


# Q1: Do significant differences exist between **modalities** within individual science disciplines?

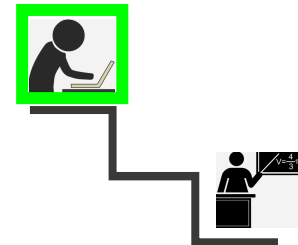
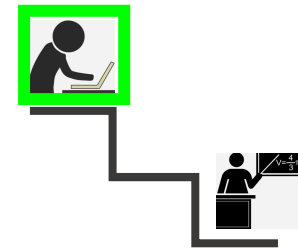
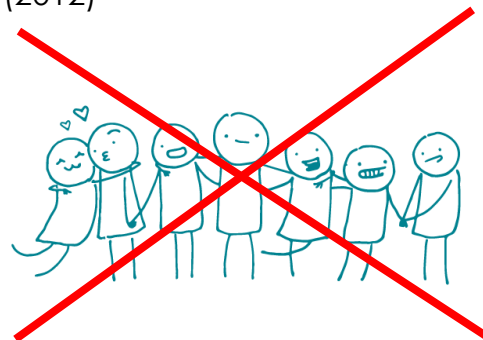
## **Chemistry (Online vs. Traditional)**

What the Literature Says

What Our Data Says



Colorado Dept of  
Higher Ed (2012)



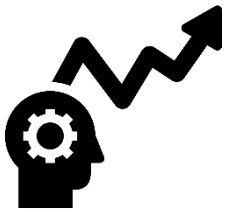


Q1: Do significant differences exist between **modalities** within individual science disciplines?

## Physics (Non-Traditional vs. Traditional)

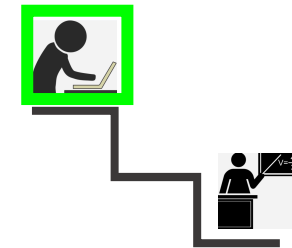
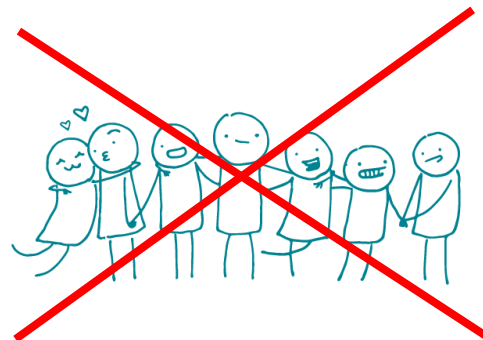
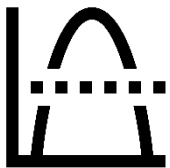
What the Literature Says

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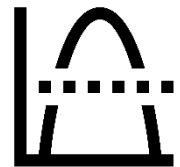
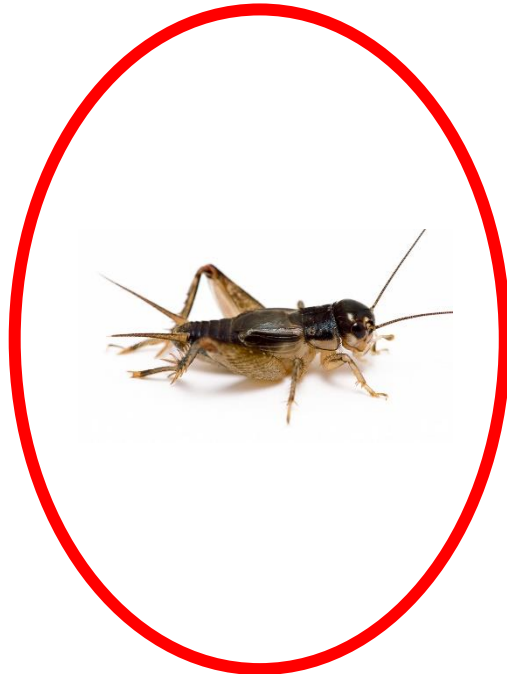
(Blended Learning)  
Martin, Blas 2009



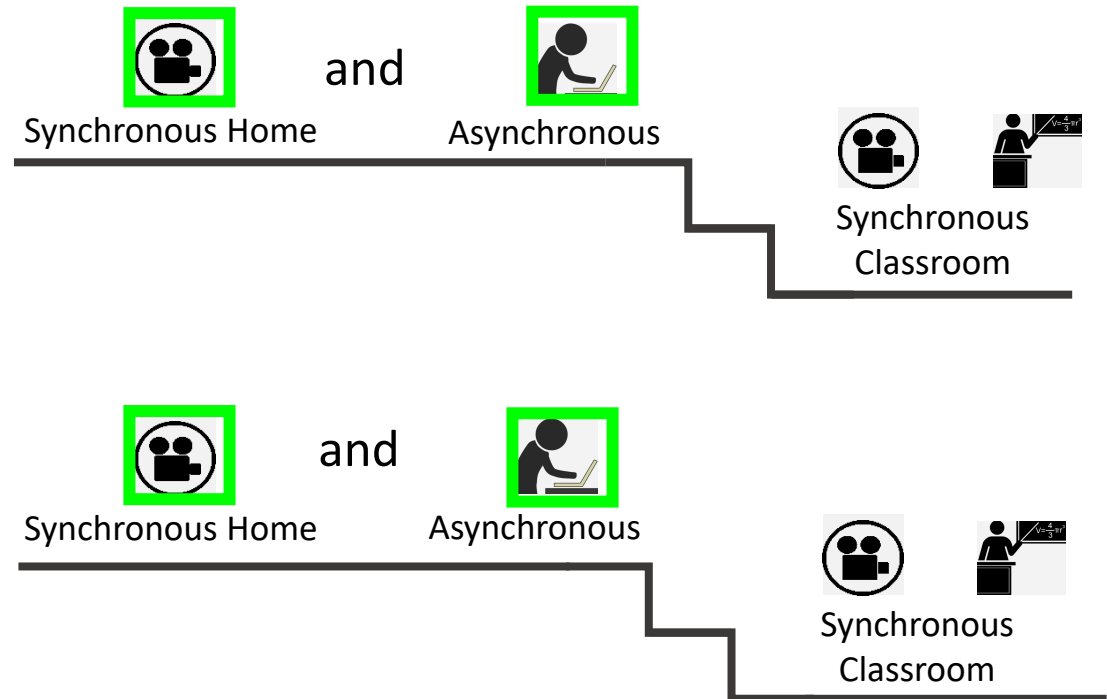
Q2: Does the **format** of the modality influence student outcomes?

## Synchronous vs. Asynchronous Execution of Physics

What the Literature Says



What Our Data Says



Q2: Does the **format** of the modality influence student outcomes?

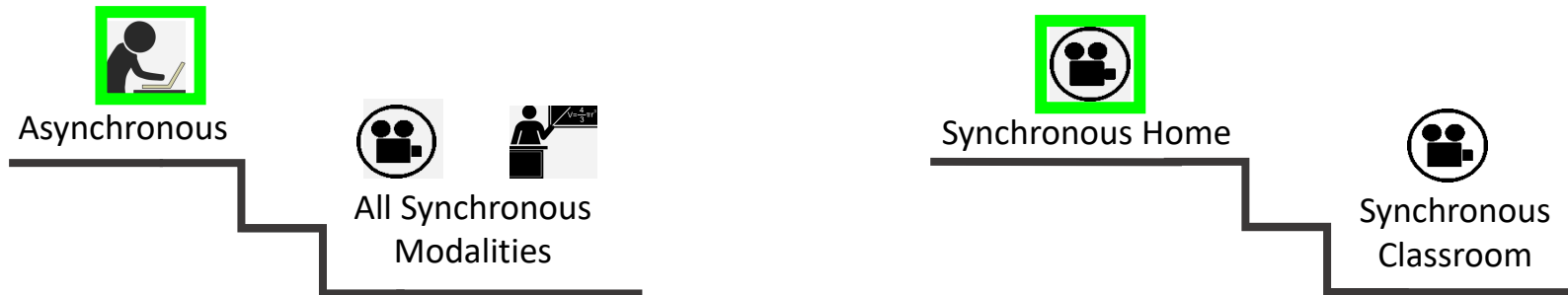
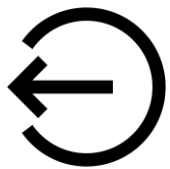
## Synchronous vs. Asynchronous Execution of Physics

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What Our Data Says

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**CAUTION: LOW COUNTS**

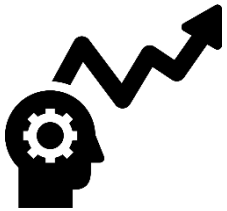


Q3: Does the **modality** of the **laboratory** course influence student outcomes?

## Online Simulations vs. Traditional Chemistry Lab

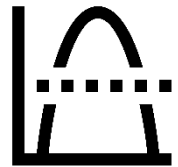
What the Literature Says

What Our Data Says



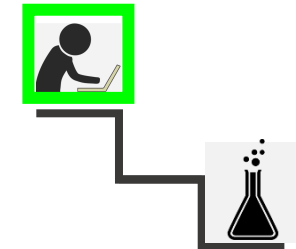
uncontrolled moderating factors:

- different institutions
- different labs



**Review Article:**

- No break-down by discipline; included engineering
- Included multiple studies of secondary schools
- Did not consider hands-on lab kits



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## Q1 Conclusions: Individual Science Disciplines

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- Students *may* be more likely to pass an online/non-traditional science lecture course than a traditional lecture course

*and*

students *are* more likely to earn a higher grade in the non-traditional format

- There does not appear to be a social support factor that increases persistence in traditional in-person science courses compared to non-traditional courses

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## Q2 Conclusions: Synchronous vs. Asynchronous Format

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- Pass rate and grade distribution did not appear to be influenced by whether the course was synchronous vs. asynchronous
- Unlike when investigating all non-traditional modalities together vs. traditional, there were differences in withdrawal rate based on the format
- Evidence of peer support factor

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## Q3 Conclusions: Science Labs

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- Students are just as likely to pass a online/non-traditional science lab course as a traditional lab course

*however*

they are more likely to earn a higher grade in the online format

- There does not appear to be a social support factor that increases persistence in traditional in-person science lab courses compared to online lab courses

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## Next Steps: Transitioning to Lab Kits

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- Compare inquiry and safety skills
- Compare content knowledge using standardized assessment rather than overall grade





# Questions

