THE GEORGE WASHINGTON UNIVERSITY
WASHINGTON, DC

School of Medicine and Health Sciences

The Use of Virtual Labs to Enhance the Laboratory Sciences Curriculum

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OBJECTIVES

1. Discuss the content rationale and development of the virtual labs
2. Review data generated from pre- and post- testing
3. Compare and contrast survey data on student perceptions of the virtual labs

PROJECT

RATIONALE -
Technical theory is difficult to teach in an online didactic course

PRIMARY OBJECTIVE -
Develop Interactive, virtual laboratories that will complement the MLS online didactic curriculum

OVERALL PROJECT GOAL

Enhance the student learning experience in a Molecular Diagnostics online didactic course

Project Aims

- **Aim One -** Develop virtual laboratory materials that will be integrated into an online MLS didactic course
- **Aim Two -** Assess the efficacy of the virtual laboratory materials
- **Aim Three -** Assess student perceptions of the virtual lab materials

Key Studies

- Interactive, computer-based simulation has been shown to have a positive impact on learner acquired skills, perception and comprehension (Ronen & Eliahu, 2000; Zaccharia, 2003; Couture, 2004; deJong, 2006)
- Computer simulation can generate higher learning outcomes, especially within the science curriculum (Akpan, 2001; Stern et al., 2008; Gelbart et al., 2009)

Project Design: Teams

Virtual Labs Development Team:
PI and Instructional Designer

Virtual Lab Review Team:
Faculty, undergraduate students, graduate students (MLS and non-MLS)

Project Design: Implementation

- Course participants randomly separated into two sections
  - **Control Section** – current curriculum in CMS. Will be given access to the virtual labs after the post-test
  - **Experimental Section** – current curriculum in CMS plus virtual labs within corresponding weekly session

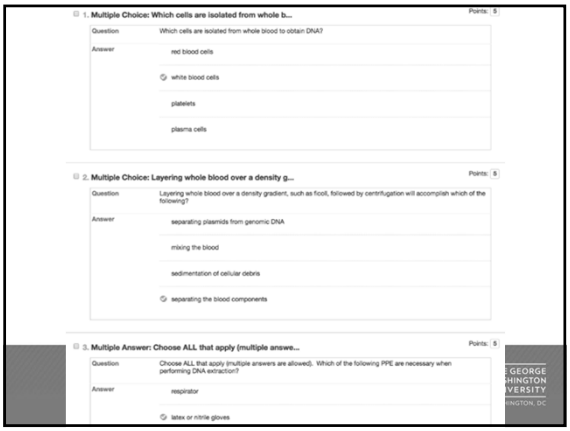
Project Design: Efficacy

PRE-TEST

- Determine baseline knowledge given prior to weekly materials containing virtual lab
- Pre-test score is not counted as part of the course grade.
- To encourage participation, students are given a 100% quiz score for completing the pre-test

POST-TEST

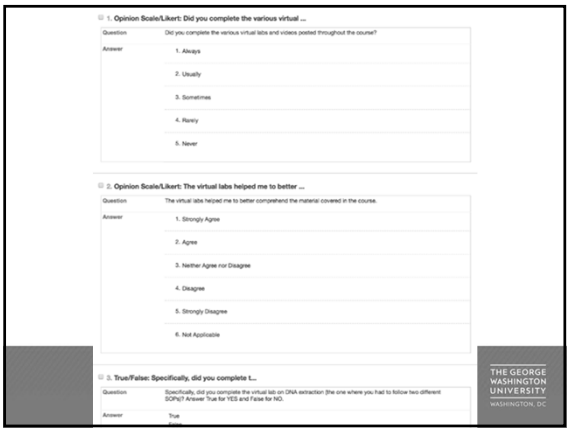
- Pre-test questions added after the weekly session that includes virtual labs
- Questions are not counted as part of the course grade



Show Pre-Quiz

Project Design: Perception

- Survey is given at the end of the semester to determine the student's perceived value of the labs
- To encourage survey completion, students are given assignment points for completing the survey


1. Opinion Scale/Likert: Did you complete the various virtual ...

Question	Did you complete the various virtual labs and videos posted throughout the course?
Answer	1. Always
	2. Usually
	3. Sometimes
	4. Rarely
	5. Never

2. Opinion Scale/Likert: The virtual labs helped me to better ...

Question	The virtual labs helped me to better comprehend the material covered in the course.
Answer	1. Strongly Agree
	2. Agree
	3. Neither Agree nor Disagree
	4. Disagree
	5. Strongly Disagree
	6. Not Applicable

3. True/False: Specifically, did you complete t...

Question	Specifically, did you complete the virtual lab on DNA extraction (the one where you had to follow two different SOPs)? Answer True for YES and False for NO.
Answer	True

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Show Survey

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Designing the Virtual Labs

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Storyboard Development

- PI and Instructional designer determined what type of labs to design
- PI developed an SOP and discussed the steps and equipment involved
- Storyboard developed using a shared Powerpoint file

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What is available?

http://learn.genetics.utah.edu/content/labs/extraction/

http://learn.genetics.utah.edu/content/labs/gel/

http://learn.genetics.utah.edu/content/labs/pcr/

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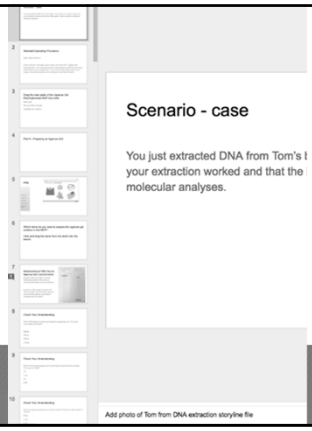

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BRANCHING

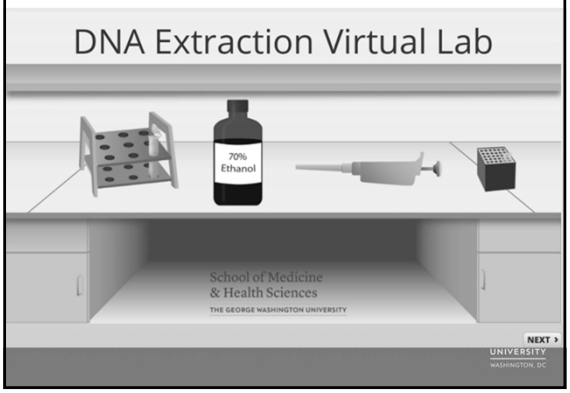
Advantages

- Better learning experience
- More realistic since mistakes can be made just like in the "real world"

Disadvantages

- Makes the design more complicated
- Takes longer to develop
- Increases chance of having glitches to fix

Show Storyboards



Demo Virtual Labs

PROJECT DATA

Efficacy Data

Mean Test Scores

	Number	Pre-Test%	Post-Test%	Exam%
CG	13	50.0	66.9	82.4
EG	20	42.5	70.0	83.5

	Number	Pre-Test%	Post-Test%	Exam%
CG	20	47.23	65.5	78.2
EG	19	46.3	69.4	80.7

Efficacy Data

		Total % of grades below 80%	Total % of grades above 79%
Experimental	Post-Quiz	53%	32%
	Exam	11%	53%
Control	Post Quiz	55%	18%
	Exam	9%	45%

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Efficacy Summary

Students who completed the virtual lab performed better on the post test than the control group, but it was not statistically signifiant

Students who completed the virtual lab performed better than the control group on a graded exam that included the techniques covered in the lab

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Perception

% Strongly Agree/Agree

	Session 1 N= 32	Session 2 N= 21	Session 3 N= 35
The virtual lab helped me to better comprehend the material	84	85	100
More familiar with DNA extraction	94	85	97
Confident that I can perform DNA extraction	81	77	79
Satisfied with the virtual lab	87	90	94
More likely to use virtual labs in the future if available	94	90	91
Virtual Labs are a valuable Tool	91	95	96
Provided good feedback	94	95	91
Easy to use	81	91	90

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Perception: Key Conclusions

Over 90% of students felt that the virtual labs were valuable and helped with their understanding of the technique

Over 75% of students felt that the virtual labs enhanced their confidence in performing the technique in a hands-on laboratory

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Student Comments

- *The virtual lab was a great tool for understanding the process of DNA extraction. If you made any errors or answered any questions wrong it provided clear feedback as to why you were wrong. This helped gain a better understanding of the process without making you feel confused. It was very straight forward and easy to do while still being educational.*
- *I like that after the concentration that my DNA was contaminated and I had to do it all over again so it really made me learn and remember things more.*
- *The SOPs make it easy to understand, follow the step-by-step instructions to extract and analyze my sample. It also increase my confidence that I will be able to perform a similar procedure in a clinical lab*

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THANK-YOU

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