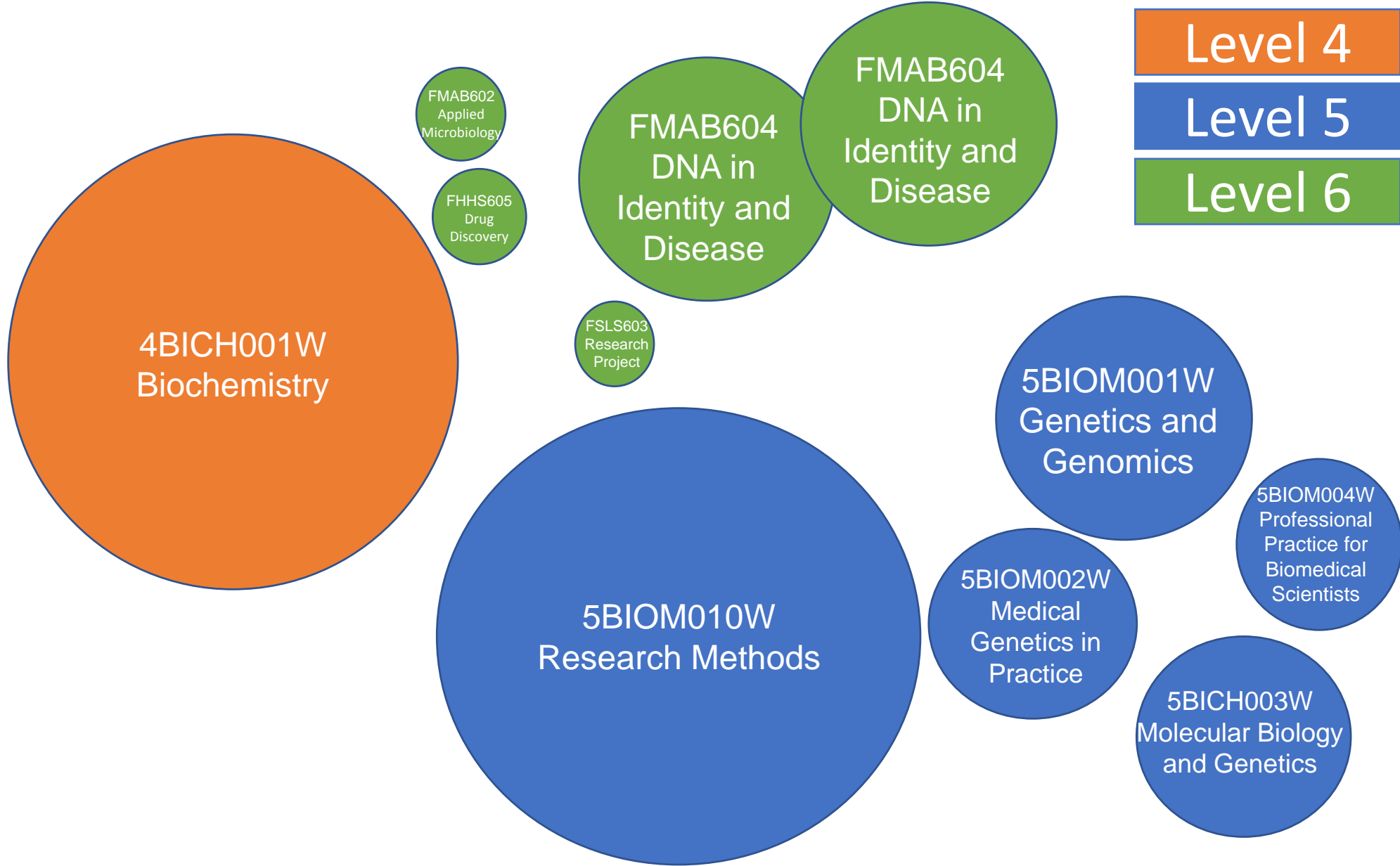


Using virtual reality to prepare Bioscience students for practical classes

Sarah K. Coleman^{*}, Emanuela Volpi[¥], Caroline L. Smith^{*}

^{*}Department of Life Sciences, FST

[¥]Department of Biomedical Sciences, FST



Level 4

Level 5

Level 6

FMAB602
Applied
Microbiology

FHHS605
Drug
Discovery

FSL603
Research
Project

FMAB604
DNA in
Identity and
Disease

FMAB604
DNA in
Identity and
Disease

5BIOM001W
Genetics and
Genomics

5BIOM004W
Professional
Practice for
Biomedical
Scientists

5BIOM002W
Medical
Genetics in
Practice

5BICH003W
Molecular Biology
and Genetics

4BICH001W
Biochemistry

5BIOM010W
Research Methods

The Labster Format

Real world scenario

Then in the lab and the problem to examine

Actions and questions to answer

Theory to read

Media to watch

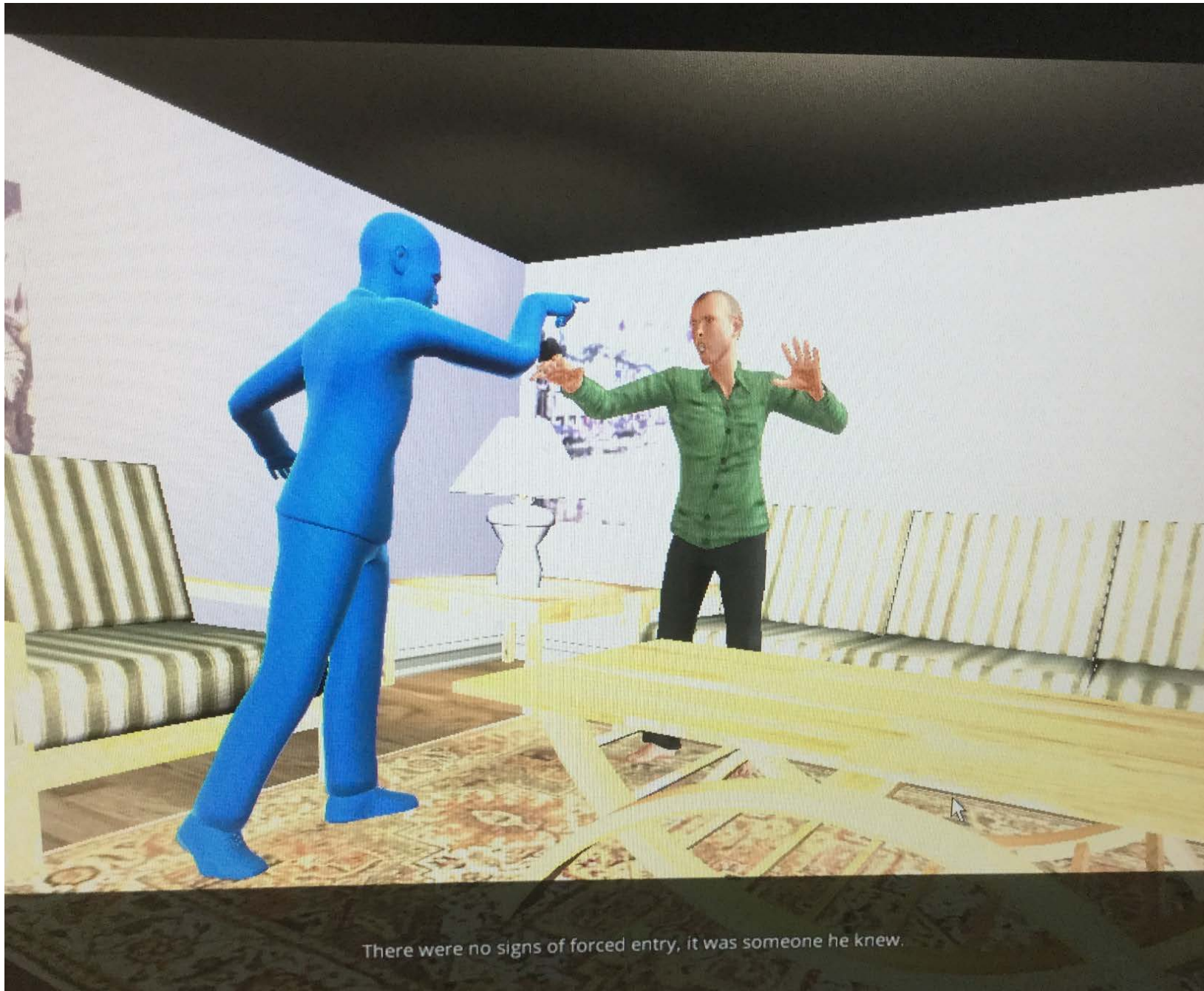
Students advance through by completing actions and answering questions – if answer is wrong they can read theory and have the question re-given.

They have a running score and progress bar.

Labster CSI

The scenario





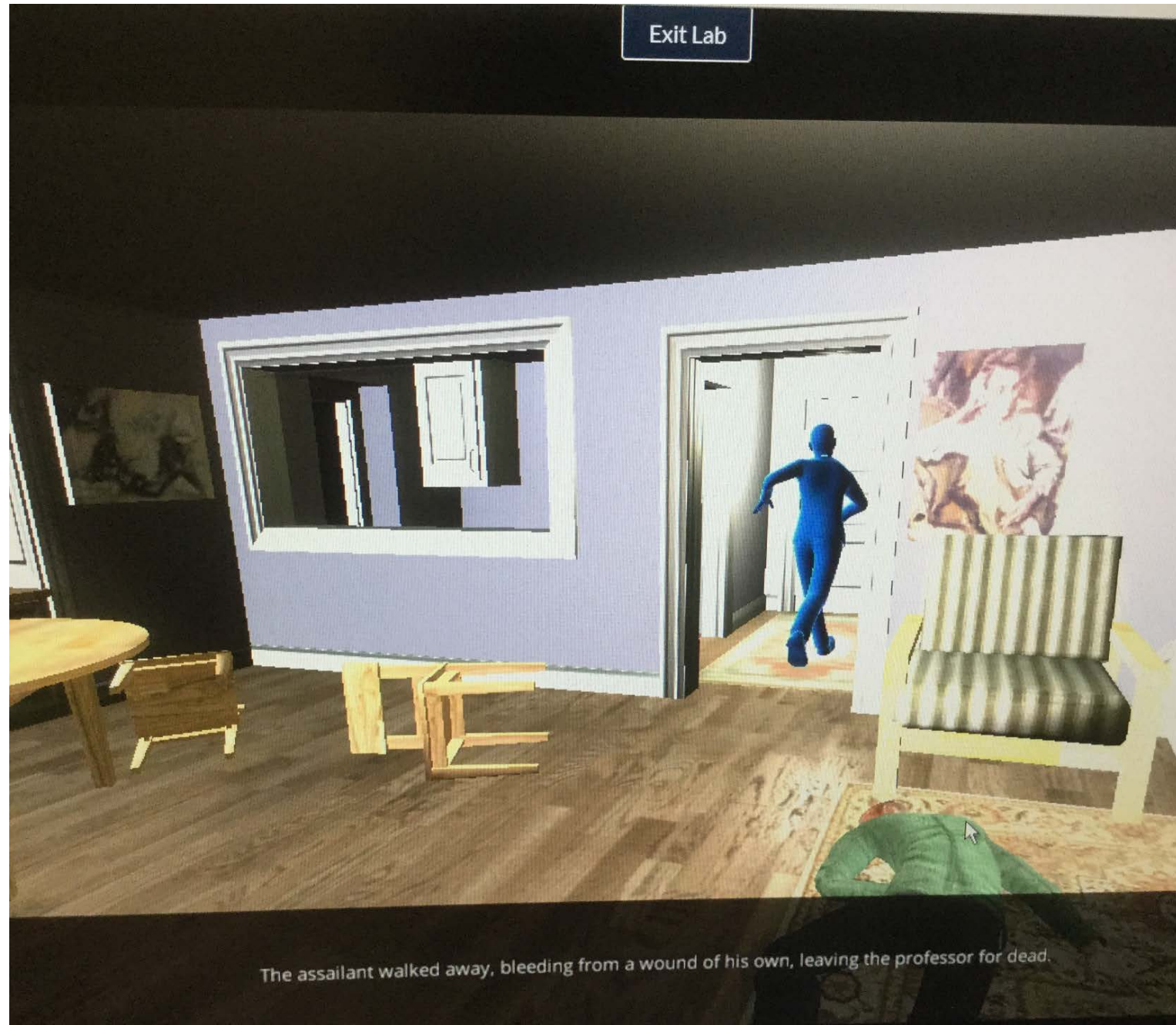
There were no signs of forced entry, it was someone he knew.

Exit Lab

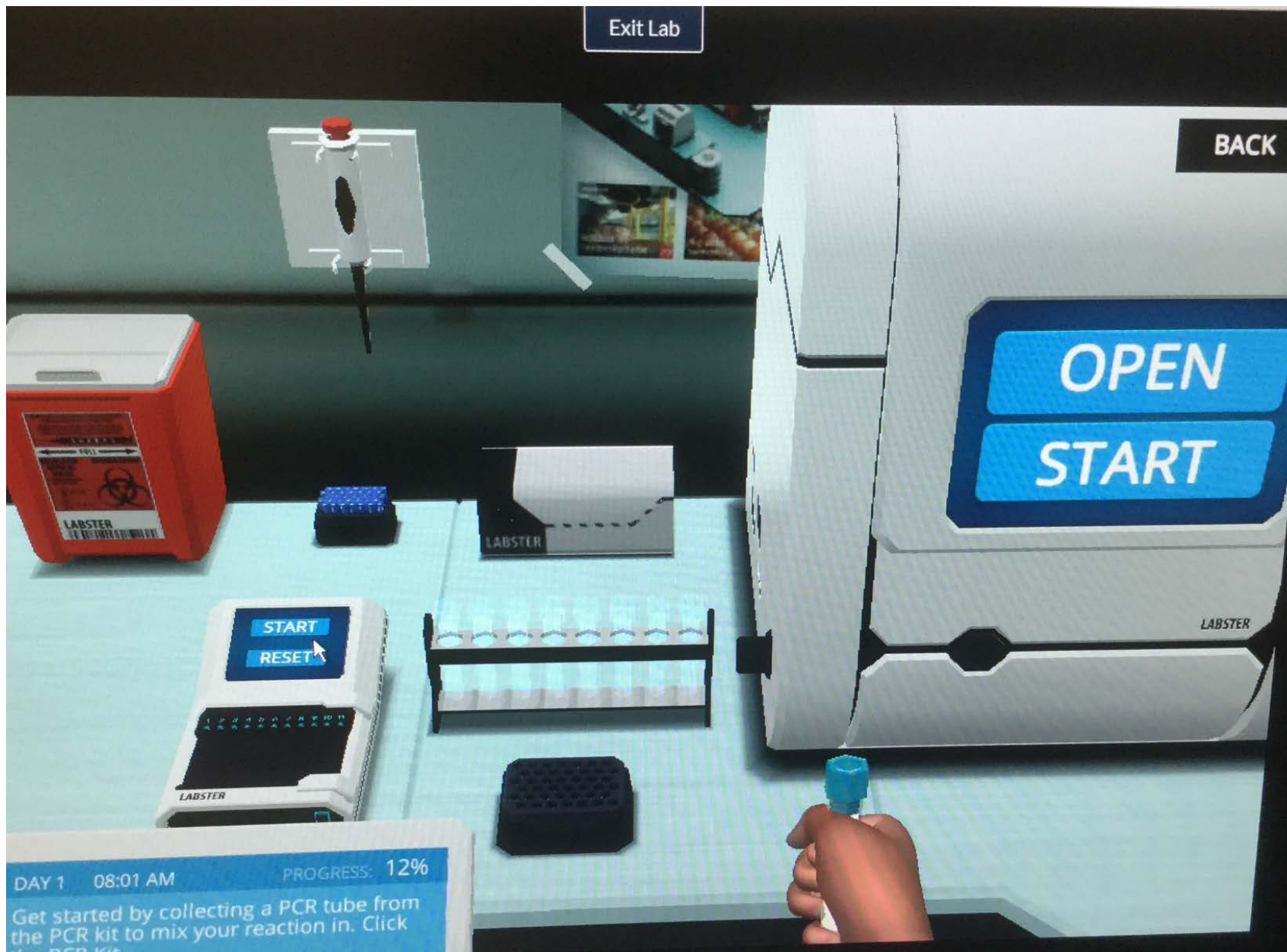


The two argued, and the professor struggled with the unknown visitor.

Exit Lab



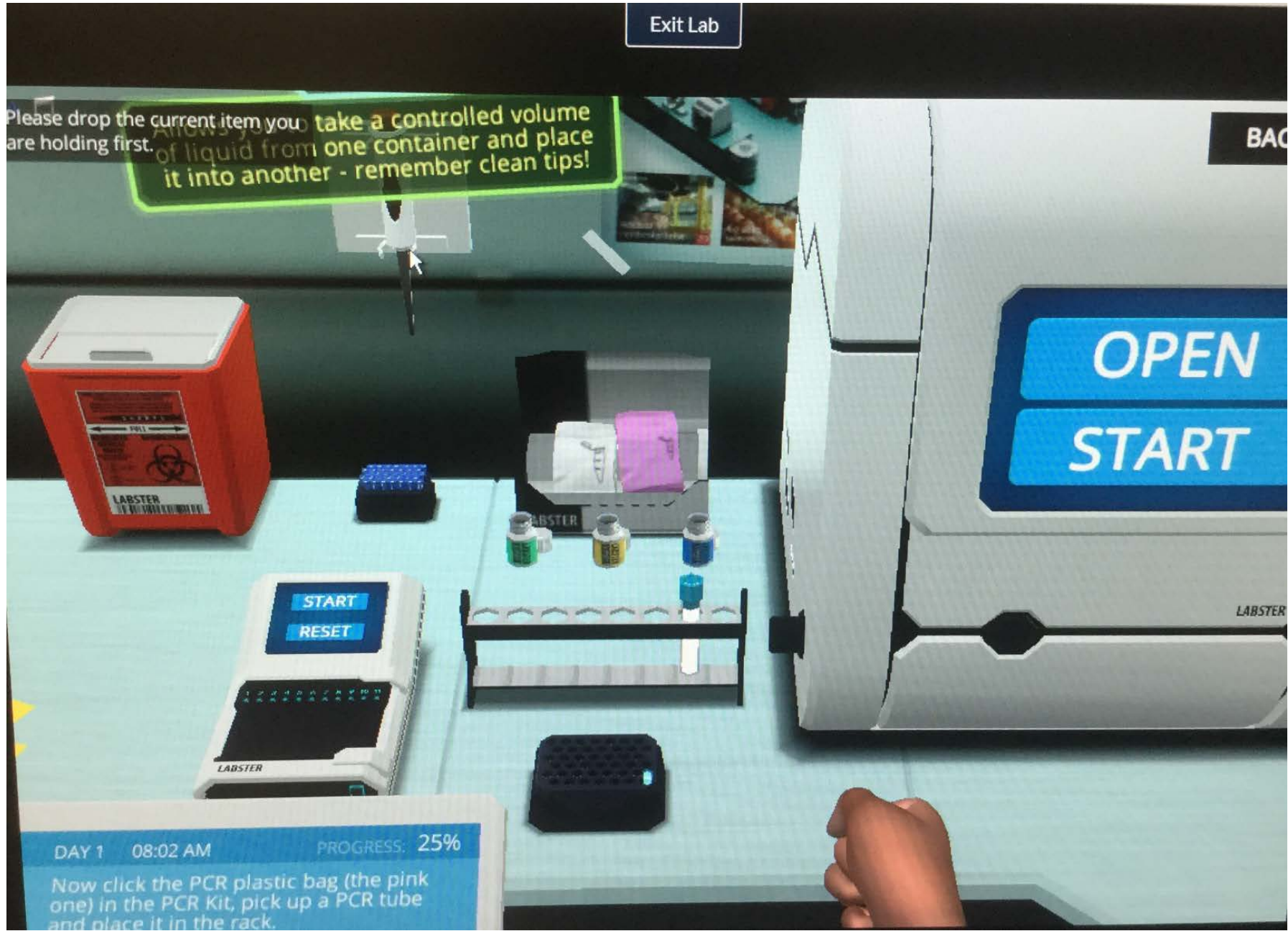
The assailant walked away, bleeding from a wound of his own, leaving the professor for dead.



Action - Setting up PCR reactions

Exit Lab

Please drop the current item you are holding first. **Allows you to take a controlled volume of liquid from one container and place it into another - remember clean tips!**



DAY 1 08:02 AM PROGRESS: 25%
Now click the PCR plastic bag (the pink one) in the PCR Kit, pick up a PCR tube and place it in the rack.

OPEN
START

Theory and questions

Exit Lab

You added Primers in PCR Tube

SCORE: 10 / 340 DAY 1 08:02 AM PROGRESS: 38%

HOME THEORY MEDIA

Mix purified DNA, primers, polymerase, and nucleotides in a PCR tube then put it on the PCR machine.

Great job!

The function of primers in a PCR reaction is to ...

- a) Denature DNA.
- b) Copy DNA.
- c) Bind specific sites on DNA.
- d) Bind random sites on DNA.

View Theory

LABSTER

The screenshot shows a virtual lab interface. At the top right, there is an 'Exit Lab' button. Below it, a notification says 'You added Primers in PCR Tube'. The main interface has a blue header with 'SCORE: 10 / 340', 'DAY 1 08:02 AM', and 'PROGRESS: 38%'. Below the header are navigation tabs for 'HOME', 'THEORY', and 'MEDIA'. A blue box contains the instruction: 'Mix purified DNA, primers, polymerase, and nucleotides in a PCR tube then put it on the PCR machine.' The main content area displays 'Great job!' followed by a question: 'The function of primers in a PCR reaction is to ...'. There are four multiple-choice options: a) Denature DNA, b) Copy DNA, c) Bind specific sites on DNA, and d) Bind random sites on DNA. At the bottom left of the interface is a 'View Theory' button. On the right side, there are blue buttons with the letters 'N' and 'T', and a 'LABSTER' logo is visible at the bottom right.

Exit Lab

You need to have a tip on your pipette in order to collect liquid.

Otherwise the pipette will be contaminated and ruin the experiment.

SCORE: 60 / 340

DAY 1 08:04 AM

PROGRESS: 69%

HOME

THEORY

MEDIA

Mix purified DNA, primers, polymerase, and nucleotides in a PCR tube then put it on the PCR machine.

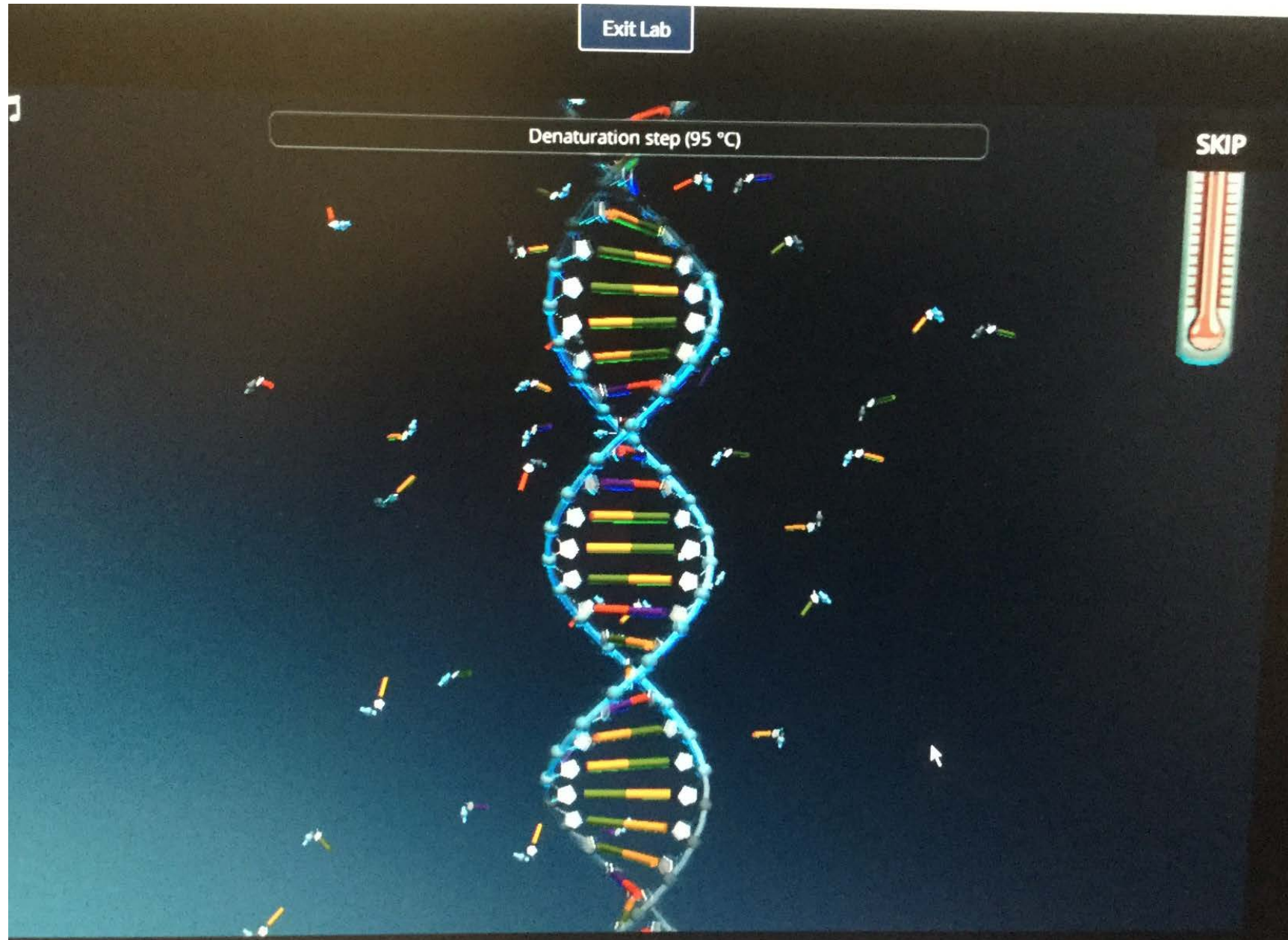
Great job!

What you will now see is an animation of what is happening on the molecular level in the PCR process.

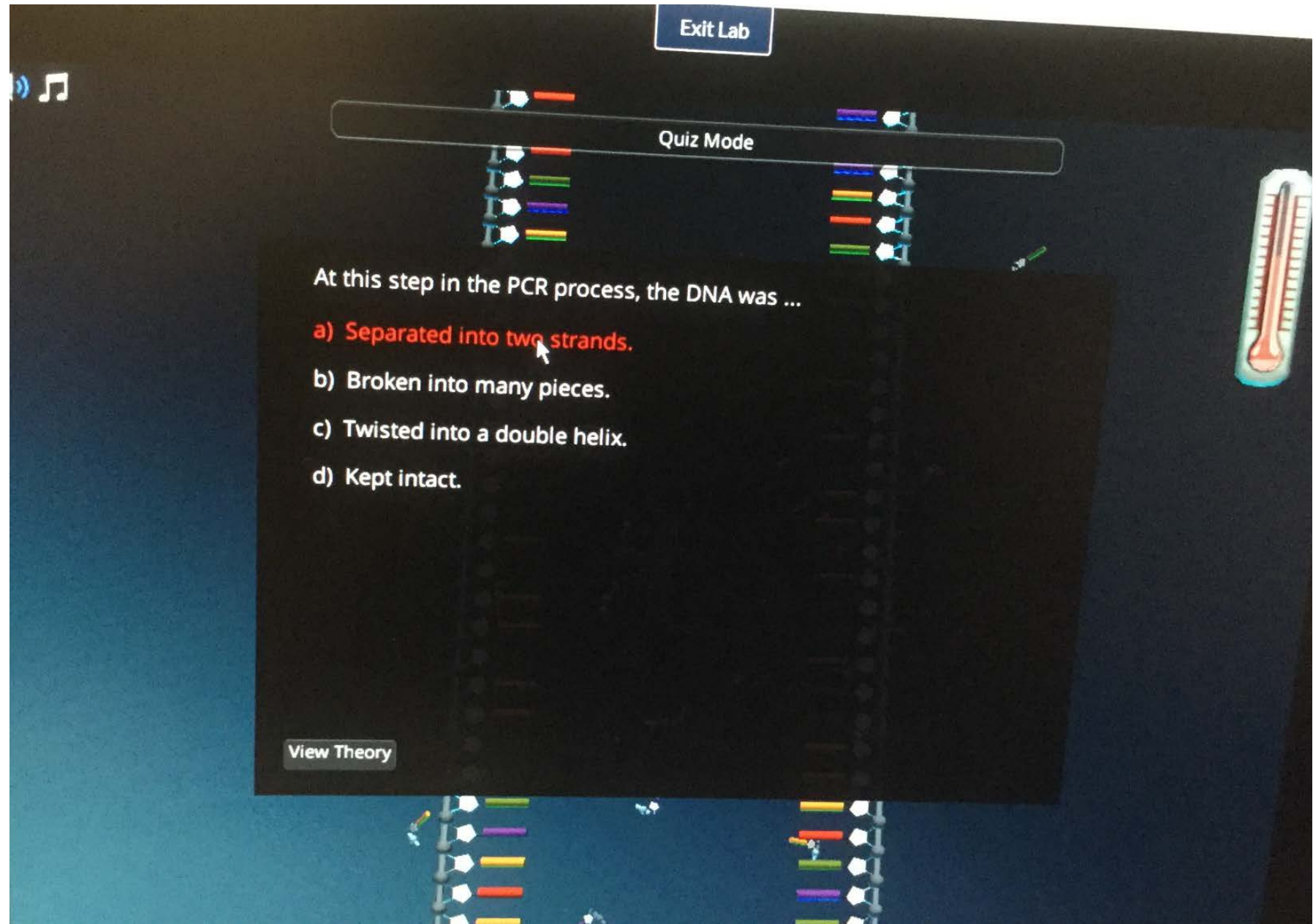
Press "Continue" to start the PCR machine.

Continue

Animations and media



Theory and questions



The screenshot shows a digital PCR simulation interface. At the top, there is a blue button labeled "Exit Lab" and a music icon. A progress bar labeled "Quiz Mode" is visible. The background features a 3D model of a DNA double helix with colored base pairs (red, green, blue, yellow). On the right side, there is a thermometer icon. A dark grey quiz question box is overlaid on the center, containing the following text:

At this step in the PCR process, the DNA was ...

- a) Separated into two strands.
- b) Broken into many pieces.
- c) Twisted into a double helix.
- d) Kept intact.

At the bottom left of the quiz box, there is a button labeled "View Theory".

Exit Lab



Quiz Mode

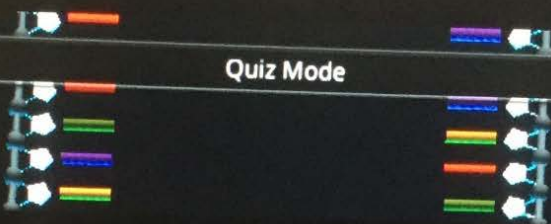


Correct!

At this step the DNA denatures and becomes single stranded.

View Theory

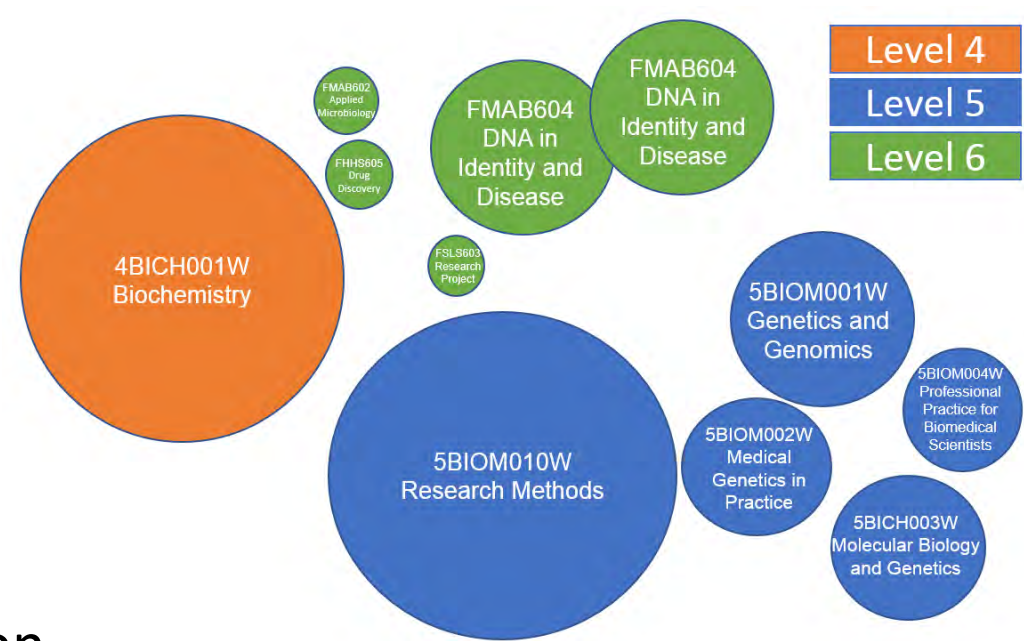
Continue



Could virtual laboratories increase student understanding and engagement within modules?

Labster survey

In general I was pleased with the simulation
I gained relevant knowledge by using the simulation
I found the simulation motivating
I feel more confident about my lab skills after the simulation
I feel that I can apply what I have learned in the simulation to
real world cases

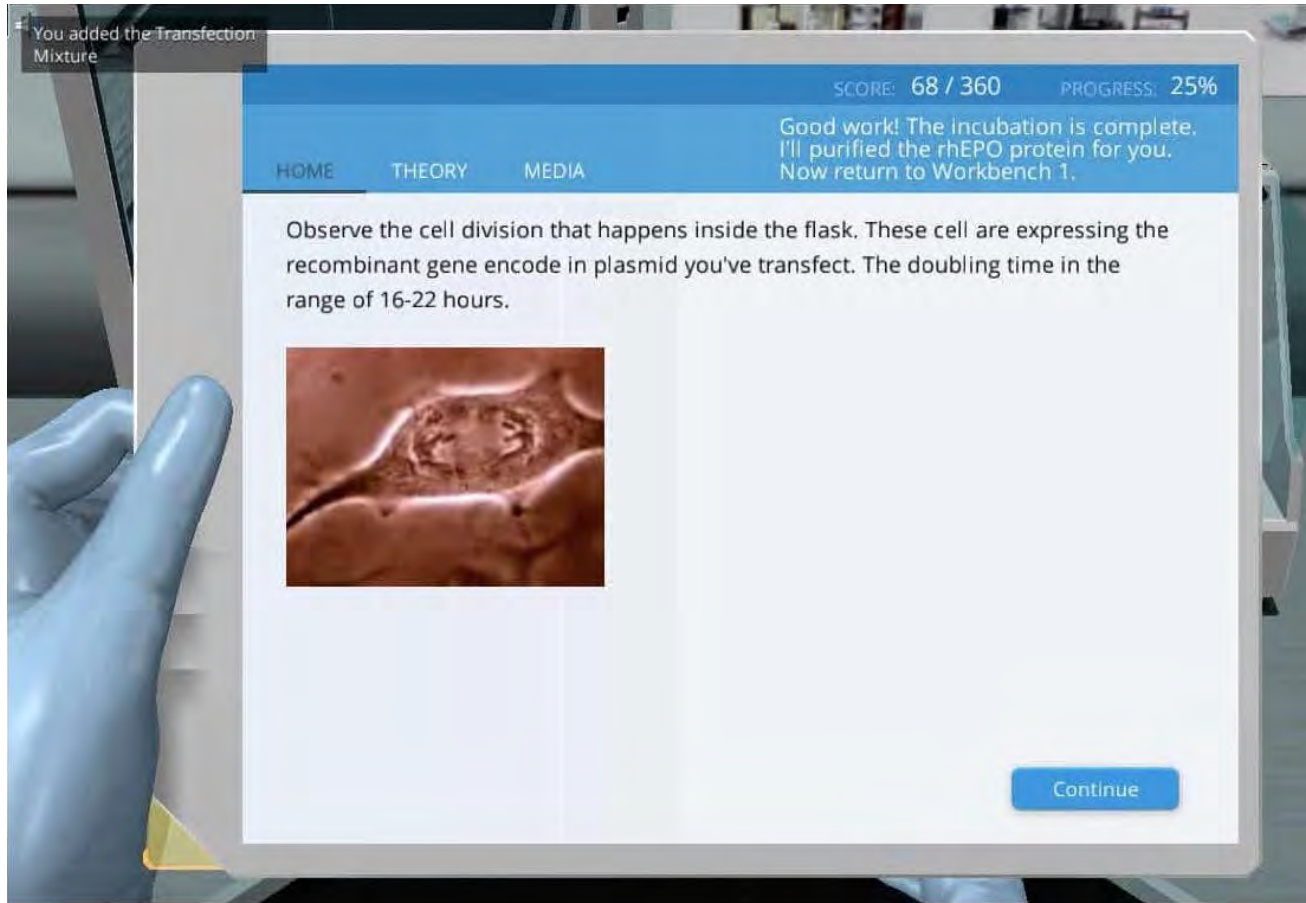


0 5 10 15 20 25

Number of students

■ Completely Agree ■ Agree ■ Disagree ■ Completely Disagree

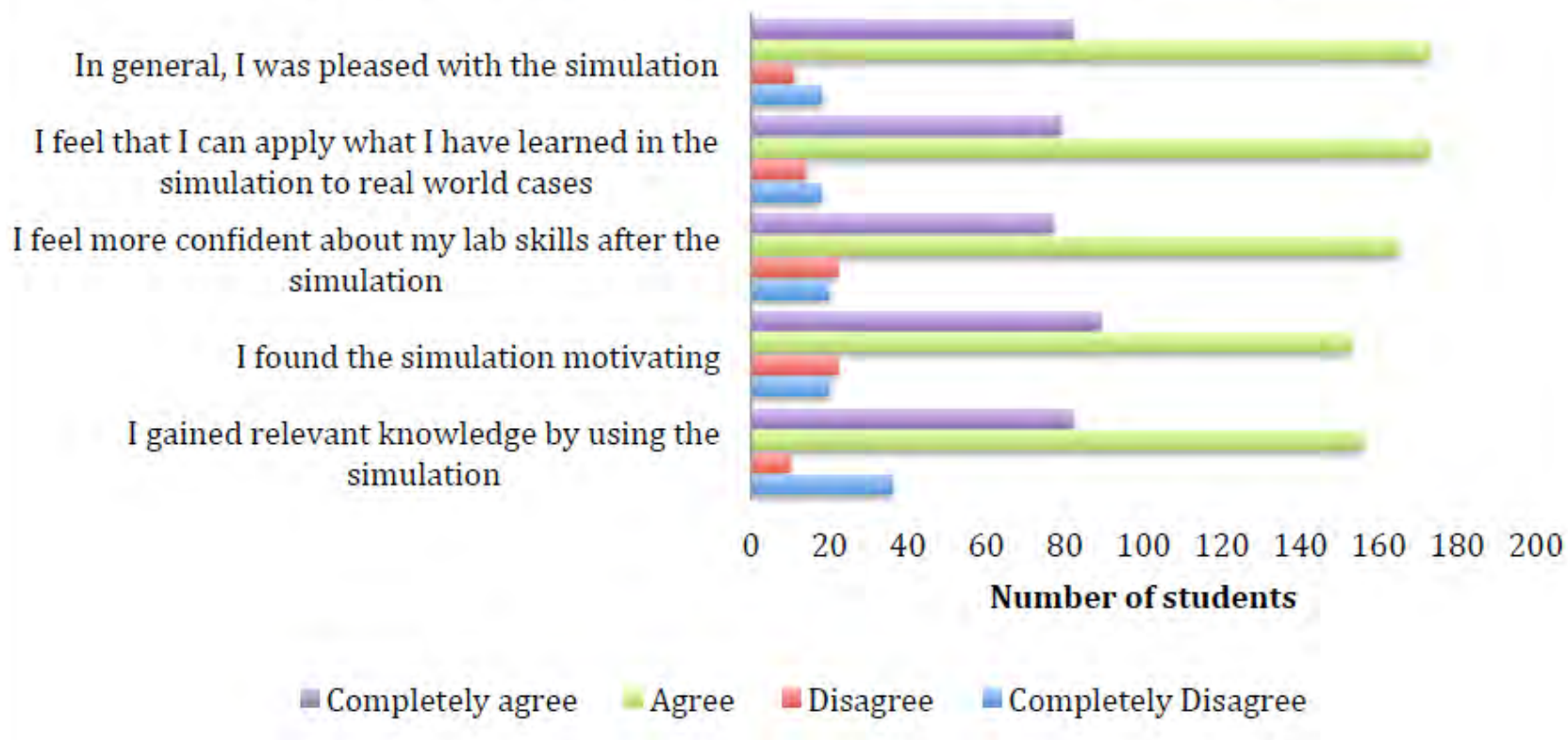
5BIOM010W Research Methods, Protein synthesis



- Scenario based around EPO (Erythropoietin)
- Students purify EPO
- This is linked to EPO drug screening in cyclists

5BIOM010W Research methods

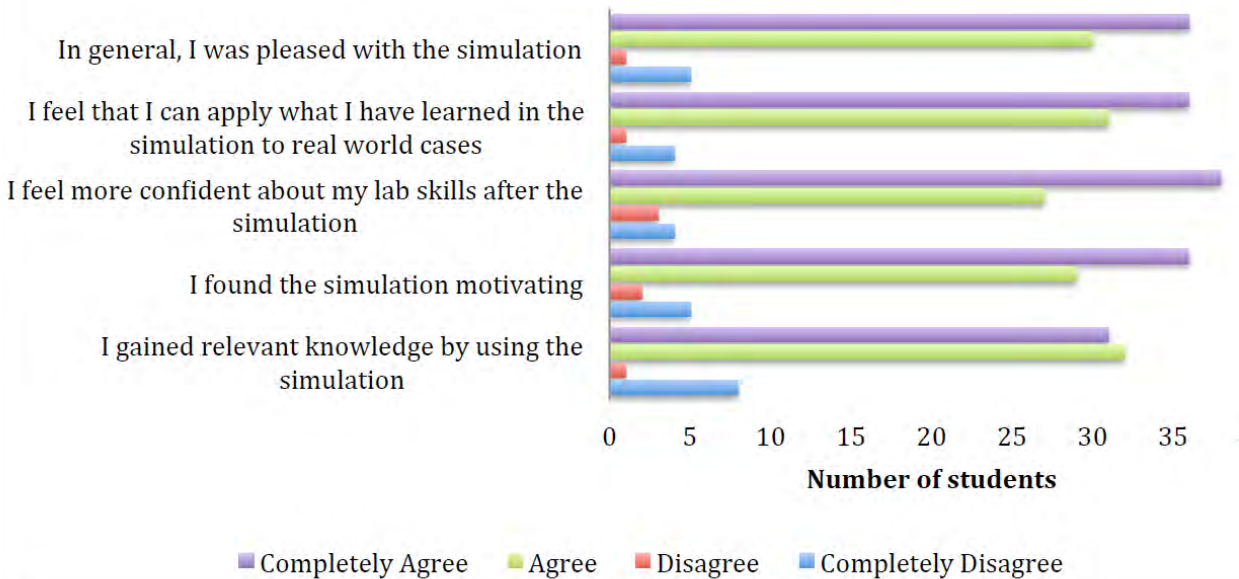
Protein Synthesis Student Evaluation



- Core all level 5 Life Science and Biomedical science students
- 294 students attempted
- 260 survey responses

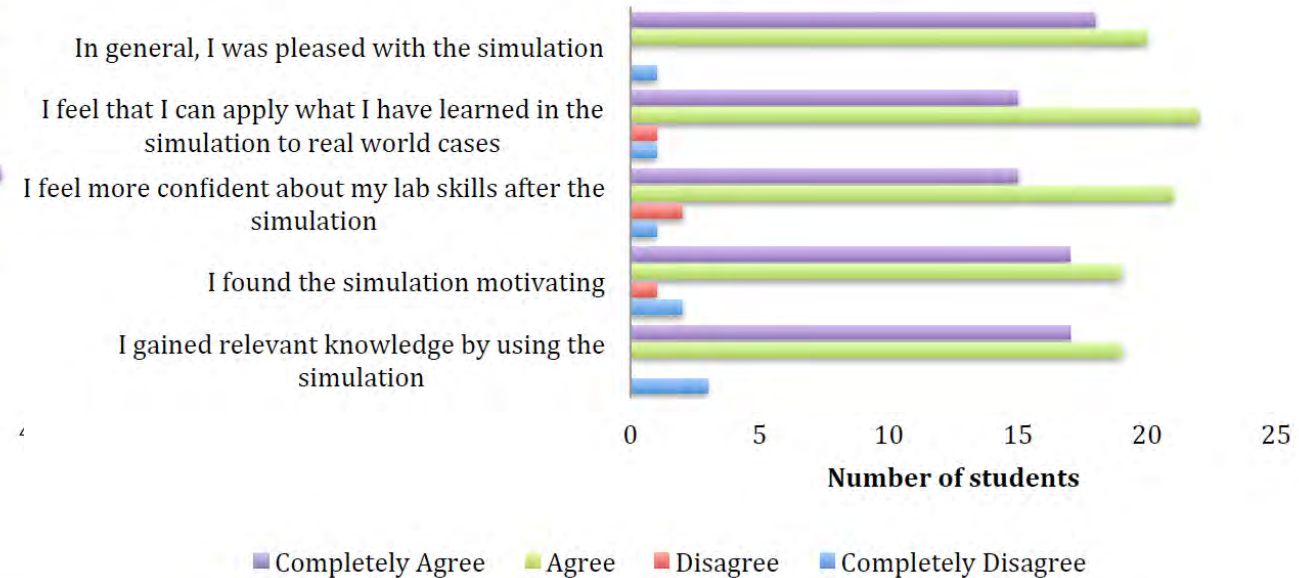
CSI evaluation, Labster survey

CSI Student Evaluation



Level 6 FMAB604 DNA in Identity and Disease
 N=75, all responded to survey, part of assessment

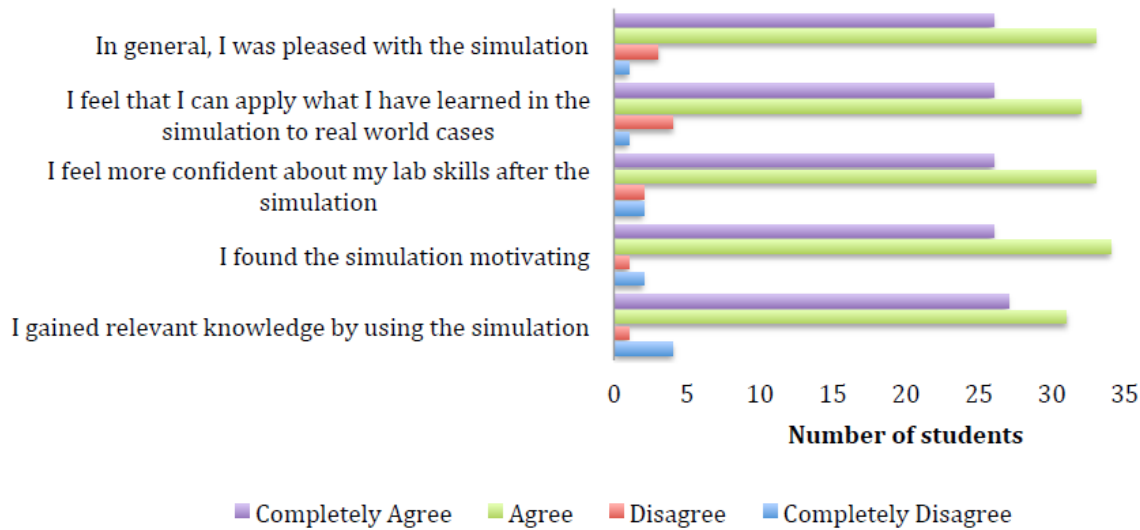
CSI Student Evaluation



Level 5 5BIOM010W, Genetics and Genomics
 N=68, 35 responded to survey

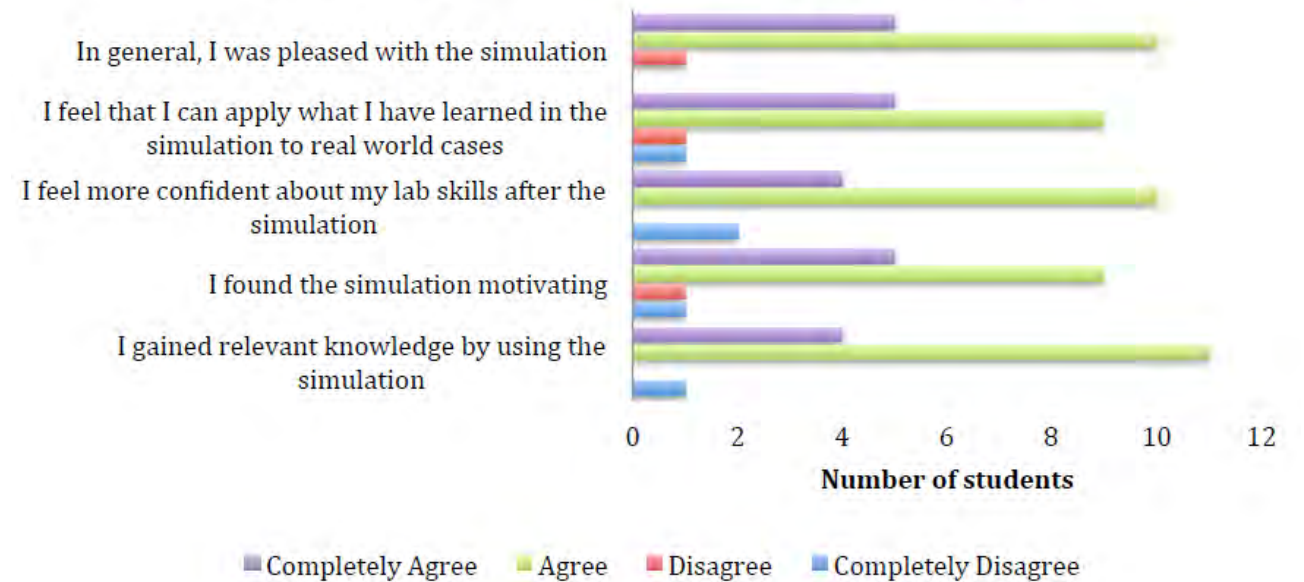
Gene regulation, Labster survey

Gene Regulation Student Evaluation



Level 6 FMAB604 DNA in Identity and Disease
N=73, all responded to survey, part of assessment

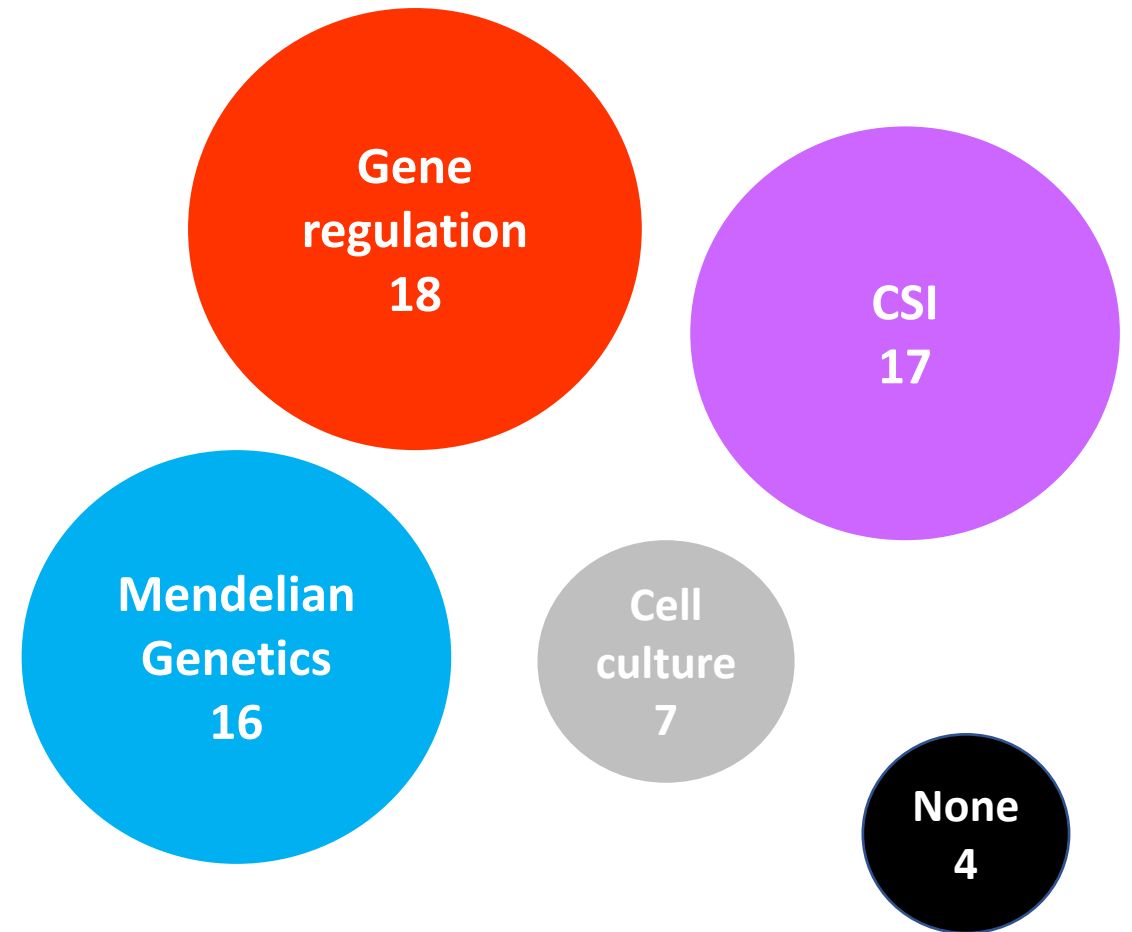
Gene Expression Student Evaluation



Level 5 5BIOM010W, Genetics and Genomics
N=88, 14 responded to survey

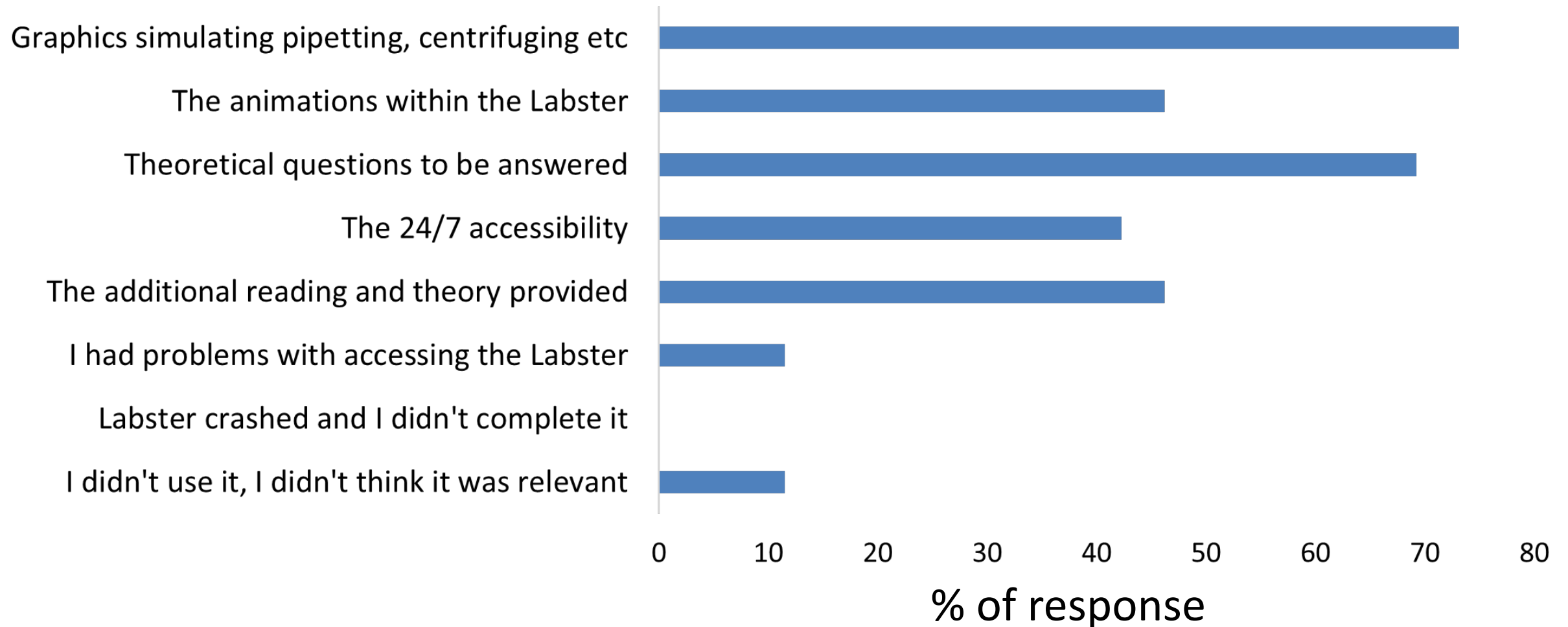
5BICH003W – Molecular Biology and Genetics

- 68 students were given Labster access
- “Gene regulation” –on the test
- “CSI”, “Cell Culture” and “Mendelian Genetics”
- 26 students completed an end of module survey

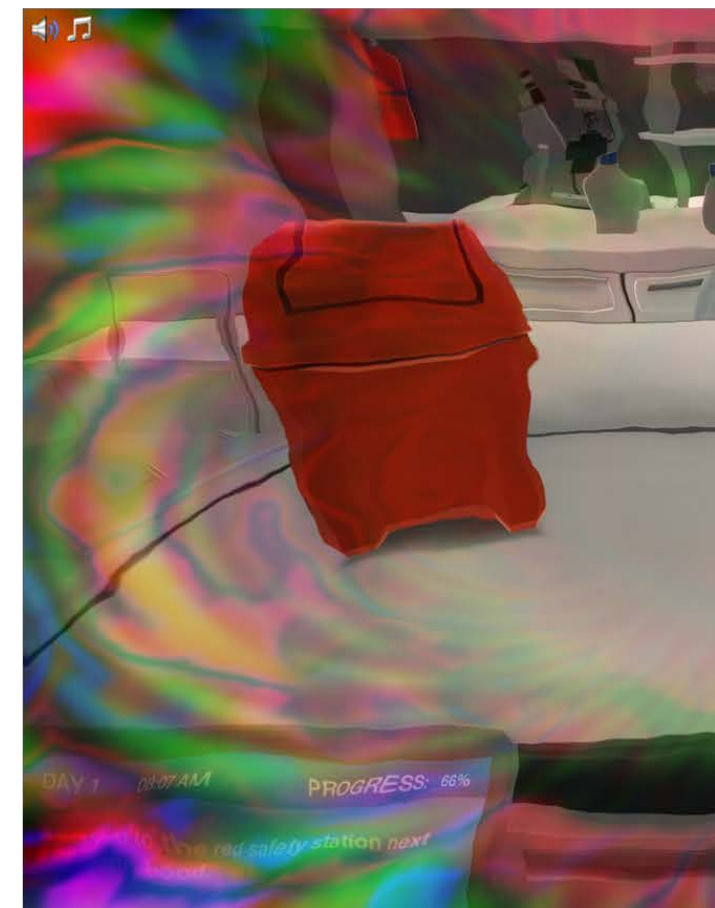
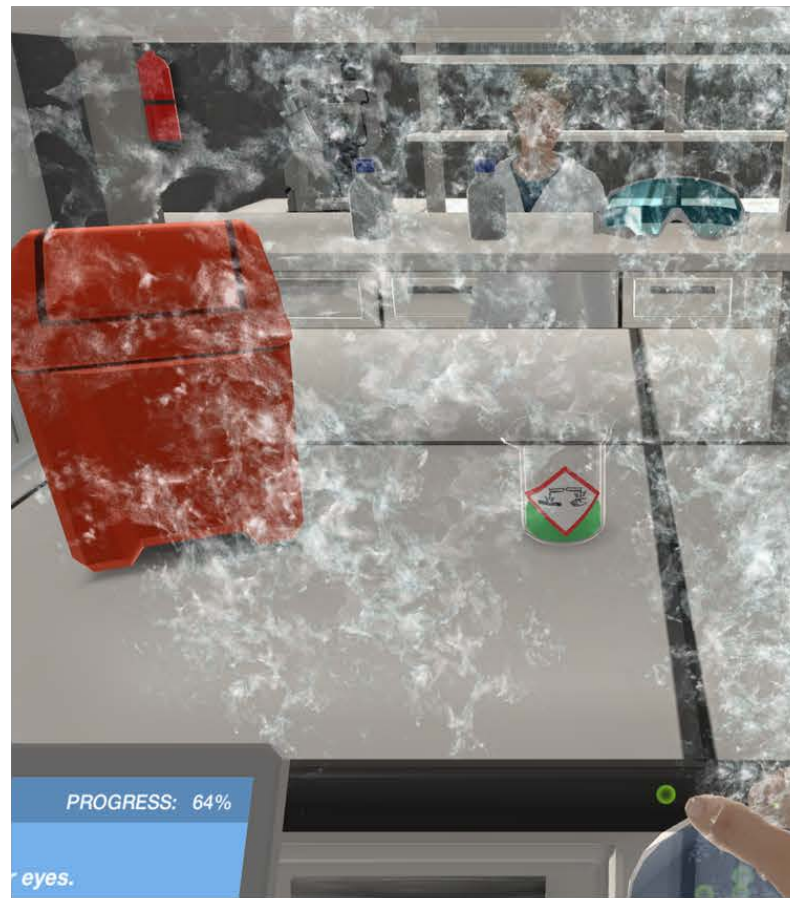


5BICH003W – Molecular Biology and Genetics

Which aspects of Labster did you like? (% responses) N=26 (from 68 students)



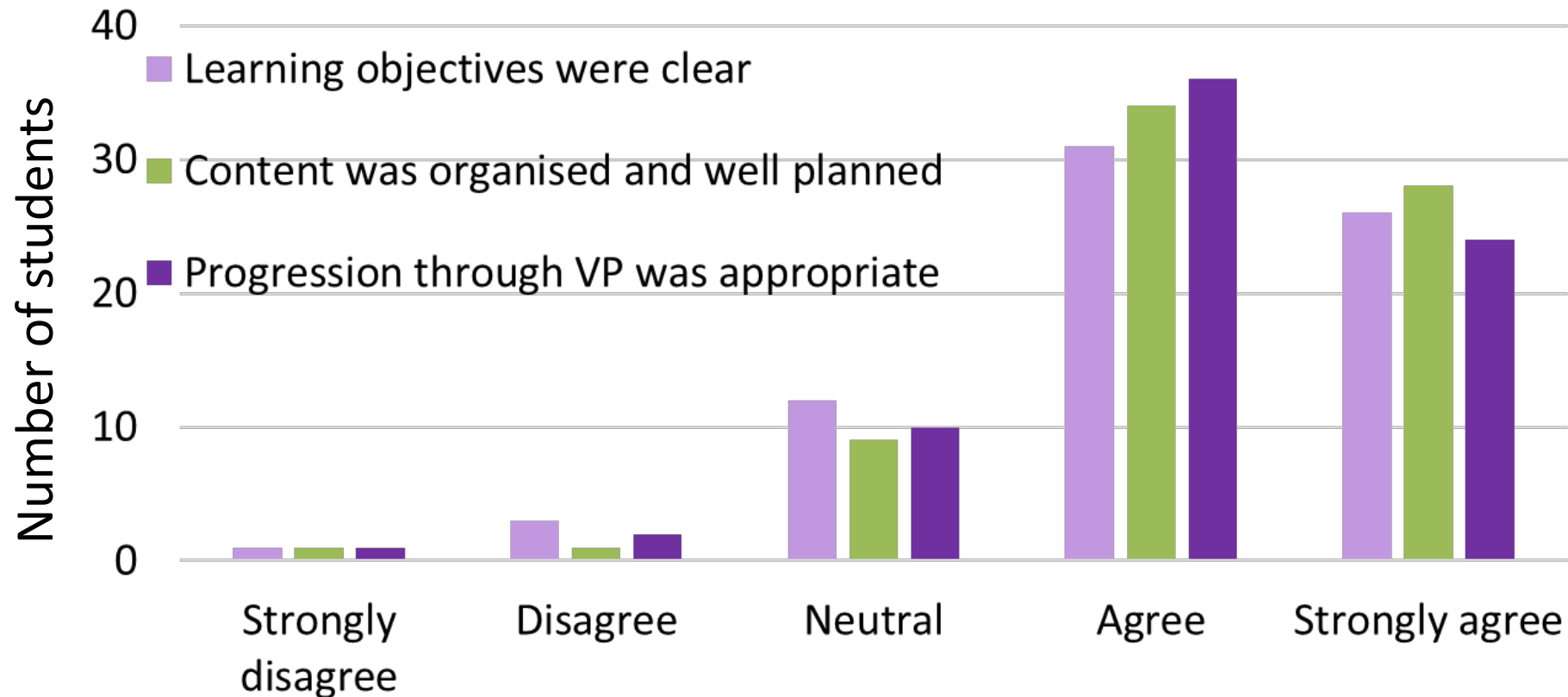
4BICH001W Biochemistry – Lab safety



4BICH001W Biochemistry – Lab safety

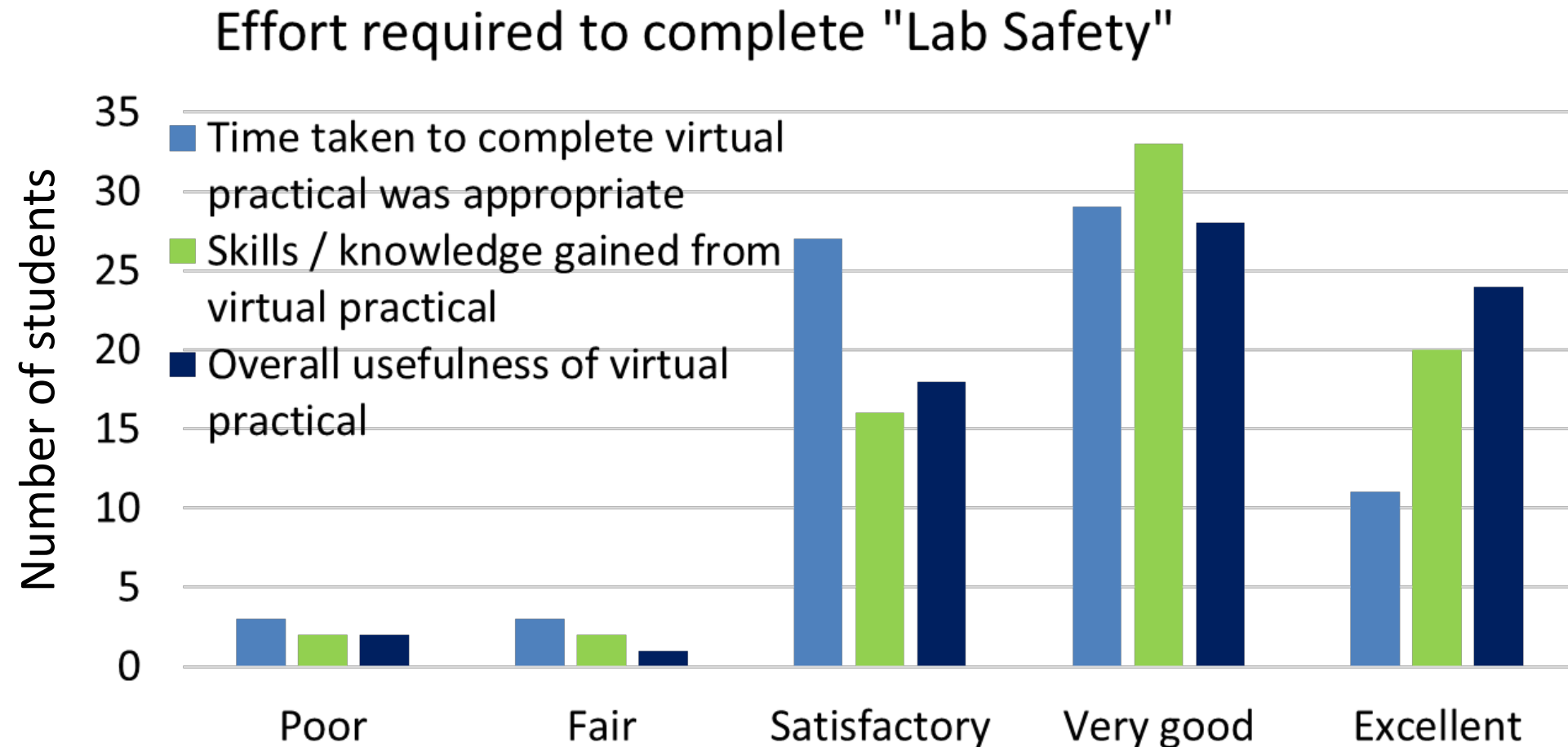
- 207 students started, 197 completed, 73 completed survey

"Lab safety" practical content



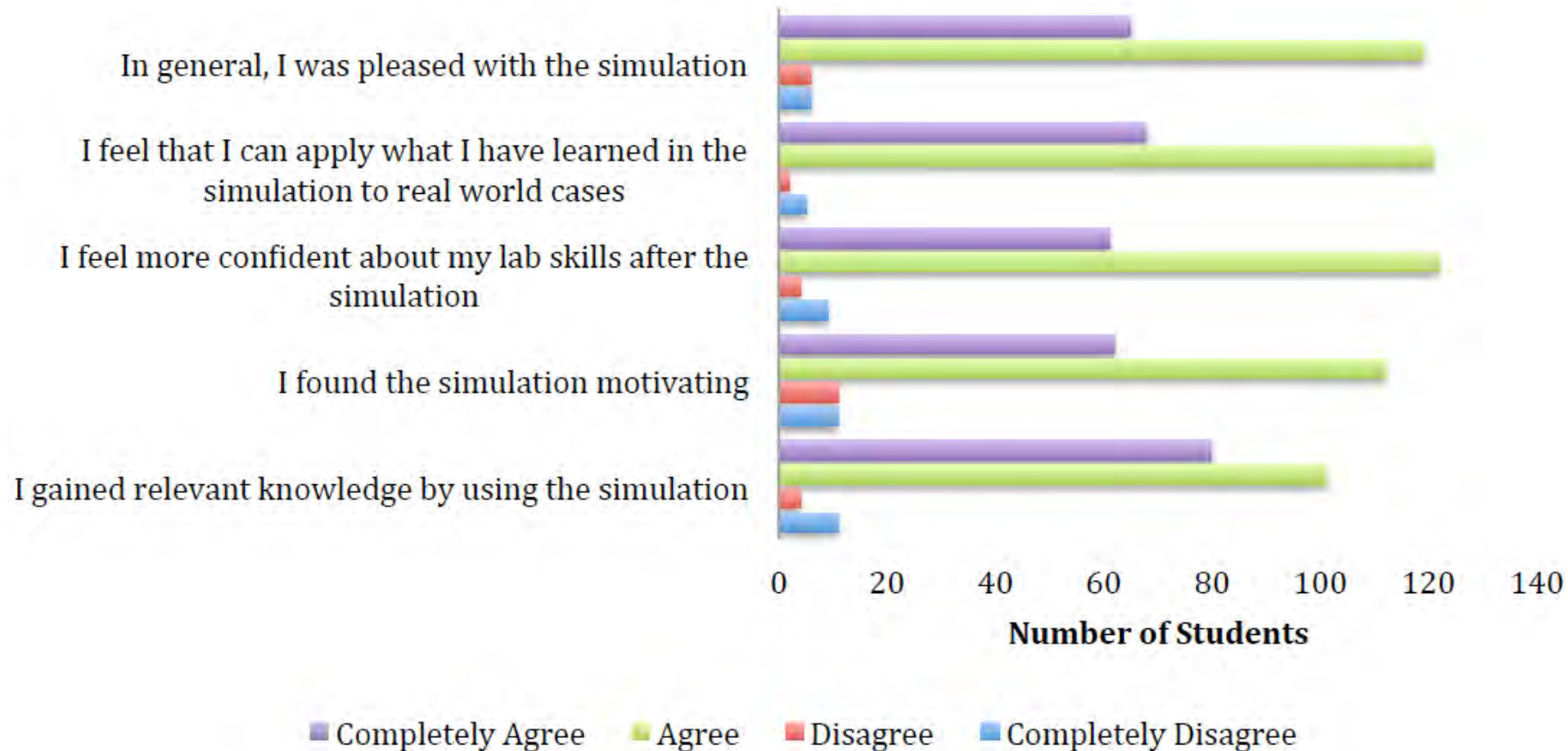
4BICH001W Biochemistry – Lab safety

- 207 students started, 197 completed, 73 completed survey



4BICH001W Biochemistry – Lab safety

Lab Safety Student Evaluation



New Labster simulations

- Ray Camilleri, Carol D'Souza and Chrystalla Ferrier – HAEMATOLOGY CASE STUDIES (live)
- Nelson Chong – GENE THERAPY AND HEART FAILURE (soon to go live)
- Nina Porakishvili – SIGNAL TRANSDUCTION (soon to go live)

LABSTER Alexander Skyum Mortensen,
Sarah Stauffer, Samuel Butcher

**UNIVERSITY OF
WESTMINSTER** 



Hematology

In this simulation, you will join a biomedical diagnostics lab and learn about the different blood components. Will you be able to identify different blood disorders based on your blood analysis results?

[Purchase Access](#)

Collaborators



Dr Carol D'Souza
Department of Life Sciences
University of Westminster



Dr Ray Camilleri
Department of Biomedical Sciences
University of Westminster



Dr Chrystalla Ferrier
Department of Life Sciences
University of Westminster

About This Simulation

Not only vampires are obsessed with blood. Haematologists love blood as well! In this simulation, you will join a biomedical diagnostics lab and learn about the different blood components. You will be taught how to make peripheral blood smears, how to use an automated blood count analyzer and how to interpret the results from these experiments. Will you be able to identify different blood disorders based on your blood analysis results?

Learning Objectives

- Learning about the organisation of a haematology laboratory, equipment selection and lab safety
- Understanding the principles, application, and limitations of selected haematological tests in relation to clinical problems
- Being able to select an appropriate test and interpret laboratory data in relation to a clinical problem

Screenshots

Lessons Learned from First Year of Use...

- Students generally like them
- Few technical issues arose – peer support
- Not embedded into Blackboard
- Easy to register, but registration is per module
- Instructor can obtain student data and meta-data as Excel spreadsheet
- More participation when compulsory or linked to summative assessment
- All staff on module should go through the virtual practical in advance

Conclusions

- The majority of students have reported that use of virtual practicals has increased understanding within modules.
- We would recommend the continued use of these Labster simulations.
- Student engagement is greatest where students can see a direct relevance of the simulation to the module, rather than as a bolt-on activity.

Acknowledgments

QUINTIN HOGG TRUST

LABSTER Alexander Skyum Mortensen,
Sarah Stauffer, Samuel Butcher

Dr Stephen Getting	FHHS605 Drug Discovery and Development	Cell culture; Transfection; HPLC
Dr Caroline Smith and Dr Pascale Gerbault	FMAB604 DNA Identity and Disease	Gene regulation; Crime scene investigation (CSI)
Dr Romy Begum	FSL603 Research Project	Gene expression; Cell culture; CSI; Lab safety
Dr Godfrey Kyazze	FMAB602 Applied Microbiology	Fermentation
Dr Andrew Dalby	5BIOM010W Research Methods	Protein synthesis
Chrystalla Ferrier	5BIOM004W Professional Practice for Biomedical Scientists	Cell culture; Bacterial isolation; HPLC
Dr Caroline Smith	5BICH003W Molecular Biology and Genetics	Gene regulation; Cell culture; CSI
Dr Emanuela Volpi	5BIOM002W Medical Genetics in Practice	Clinical cytogenetics; Medical genetics; Next generation sequencing
Dr Lorna Tinworth	5BIOM001W Genetics and Genomics	CSI; Gene expression; Medical genetics; Mendelian inheritance; Monogenetic disorders
Dr Sarah K Coleman	4BICH001W Biochemistry	Laboratory safety