

Enhancing Practical Learning in Postgraduate Education: Integrating Digital Tools and Team-Based Learning in MSc Medical Microbiology

**Dr Hannah Serrage, Dr Stavros Panagiotou, Dr Jenny Herbert and
Dr Moustafa Alissa Alkhalaf**

MSc Medical Microbiology Programme



MSc Medical Microbiology

2024 – 2025: 42 students

Diverse cohort comprising 78% international students (24/25)

6, 15-30 credit modules

Provision of asynchronous and synchronous content

Enhance accessibility of content through flexible approach to learning



**ID: MSc Medical Microbiology
logo**

Practical microbiology

15 credit, 3-week module

An intensive introduction to key microbiological techniques

Research and microbiological techniques

Complemented by guided tutorials and drop in sessions



ID: Agar plate inoculated with *Staphylococcus aureus* with the words 'MSc Med Micro'

Practical microbiology: the issues

Diverse cohort with varied microbiology experience

Traditionally guided by paper protocols

Passive learning with little room for critical thinking

Student understanding is poor, which hinders learning throughout the programme

What can we do to improve this?



ID: Agar plate inoculated with bacteria depicting flowers and words.

Enhancing Practical Microbiology

Aim: To enhance active learning and critical thinking across practical microbiology

Reinvigorate learning resources

Articulate Rise 360

Interactive handbook with opportunities for self-assessment

Consolidate and apply learning

Mentimeter

Use of interactive polls to review understanding and experimental outcomes

LAMS

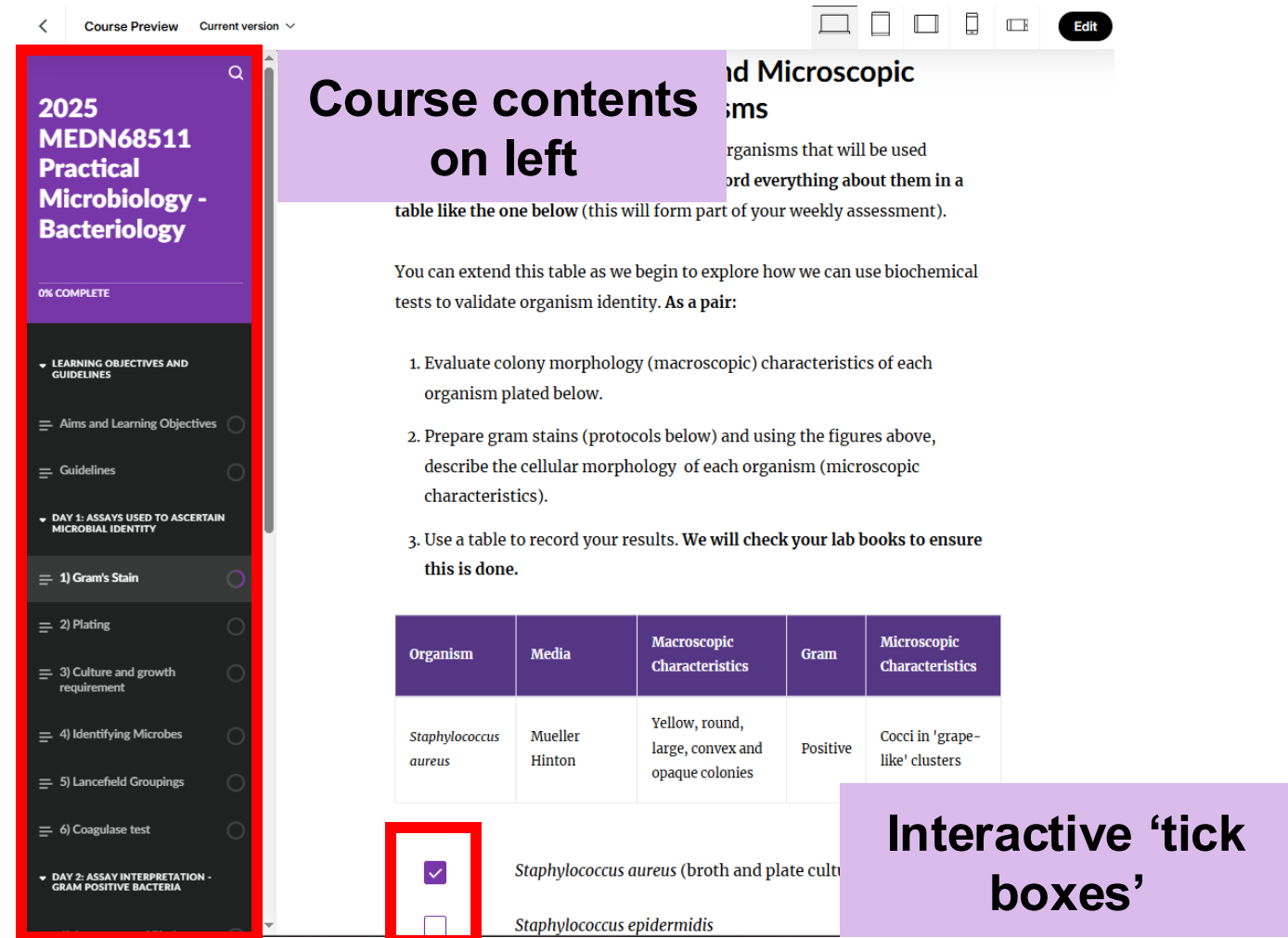
Series of multiple-choice questions (MCQs) and application exercises

Reinvigorating Learning Resources

Distributed both a standard laboratory handbook and digital e-handbook to students

Students were given the option to use either resource, or both

All information was the same, but interactive content available in e-handbook



Course Preview Current version

2025 MEDN68511 Practical Microbiology - Bacteriology

0% COMPLETE

LEARNING OBJECTIVES AND GUIDELINES

- Aims and Learning Objectives
- Guidelines

DAY 1: ASSAYS USED TO ASCERTAIN MICROBIAL IDENTITY

- 1) Gram's Stain
- 2) Plating
- 3) Culture and growth requirement
- 4) Identifying Microbes
- 5) Lancefield Groupings
- 6) Coagulase test

DAY 2: ASSAY INTERPRETATION - GRAM POSITIVE BACTERIA

Course contents on left

and Microscopic

organisms that will be used
ord everything about them in a
table like the one below (this will form part of your weekly assessment).

You can extend this table as we begin to explore how we can use biochemical tests to validate organism identity. As a pair:

- Evaluate colony morphology (macroscopic) characteristics of each organism plated below.
- Prepare gram stains (protocols below) and using the figures above, describe the cellular morphology of each organism (microscopic characteristics).
- Use a table to record your results. We will check your lab books to ensure this is done.

Organism	Media	Macroscopic Characteristics	Gram	Microscopic Characteristics
<i>Staphylococcus aureus</i>	Mueller Hinton	Yellow, round, large, convex and opaque colonies	Positive	Cocci in 'grape-like' clusters
<input checked="" type="checkbox"/> <i>Staphylococcus aureus</i> (broth and plate cult				
<input type="checkbox"/> <i>Staphylococcus epidermidis</i>				

Interactive 'tick boxes'

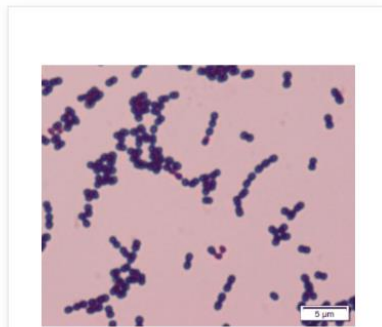
Reinvigorating Learning Resources

E-handbook interactive content included:

Flash cards

Gram Positive Bacteria

Gram positive species possess a thick, dense peptidoglycan layer in their cell walls.



Practice Questions

How many of the organisms plated on agar are **gram positive**?

6



Acceptable responses: Answer 1, 6, Six



Correct

Ask a demonstrator if you need more help!

Matching exercises

Match the growth requirement with it's description

≡ 4	Hardy	An organism that can grow in most conditions	4 v
≡ 5	Strict aerobe	An organism that requires oxygen to grow	5 v
≡ 3	Facultative anaerobe	An organism that can survive and grow without oxygen	v

Flash cards that 'flip' with image descriptions

Open ended or multiple-choice practice questions

Match the item with its description

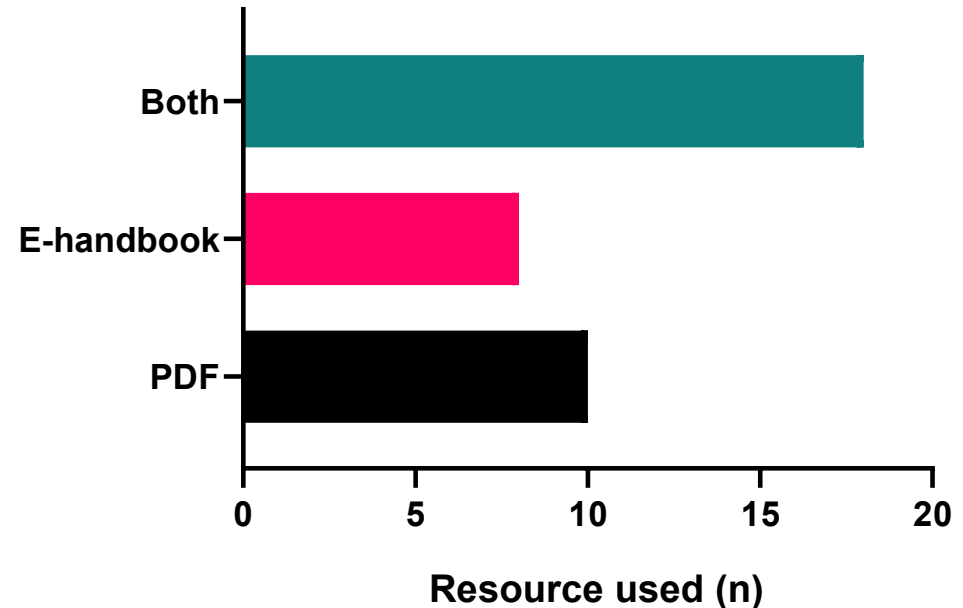
Learning Resources: Student Opinion

85% of students responded to survey

50% students exploited both resources simultaneously

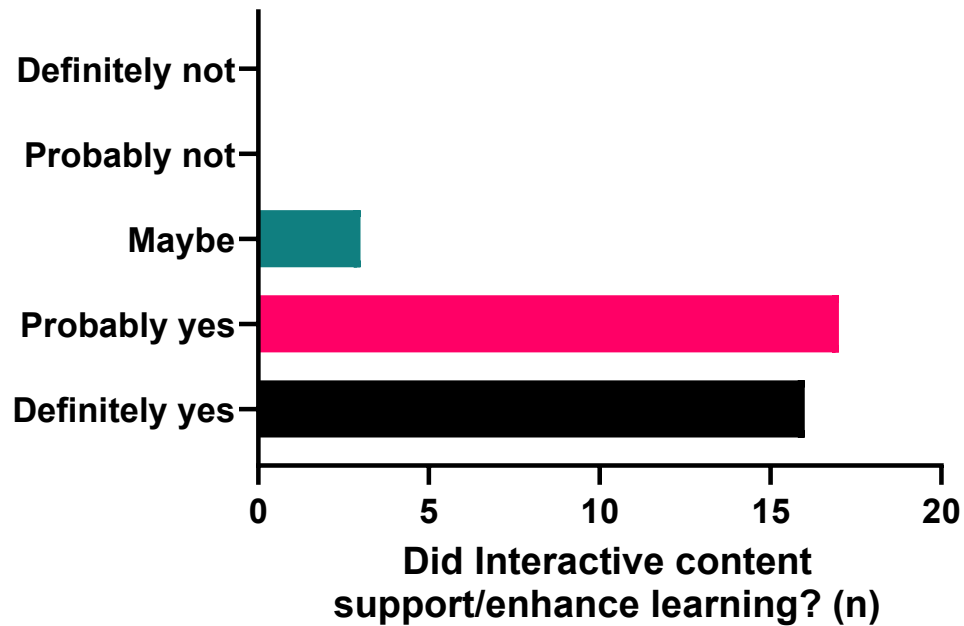
Indicating that the standard handbook was 'easier to take notes on'

But interactive content, such as practice questions in the e-handbook, proved invaluable

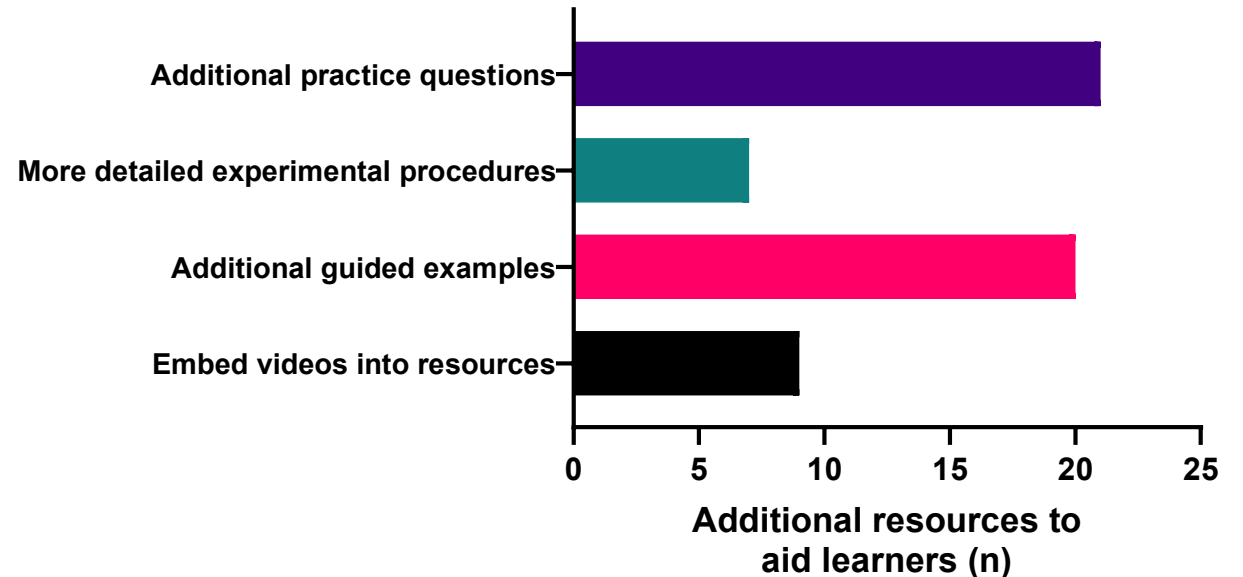


Students used both resources to guide their learning

Learning Resources: Student Opinion



Students were very positive about interactive content



Felt additional improvements were required to improve learning outcomes

Learning Resources: Outcomes

Rise articulate allows for self-paced learning

Students enjoyed interactive content, but felt paper protocols were still important for writing notes

Additional interactive content has been requested for students to continue to practice in their own time

How can we consolidate learning from practical sessions?

Consolidate and Apply Learning

Previously experimental outcomes were not discussed or disclosed

Resulting in poor student understanding and a lack of consolidation

Incorporated Mentimeter and LAMS into learning

Focus on LAMS today: interactive platform to consolidate learning



**ID: QR code to redirect to
menti.com, code 3616 3032**

Consolidate and Apply Learning: LAMS

Team based learning

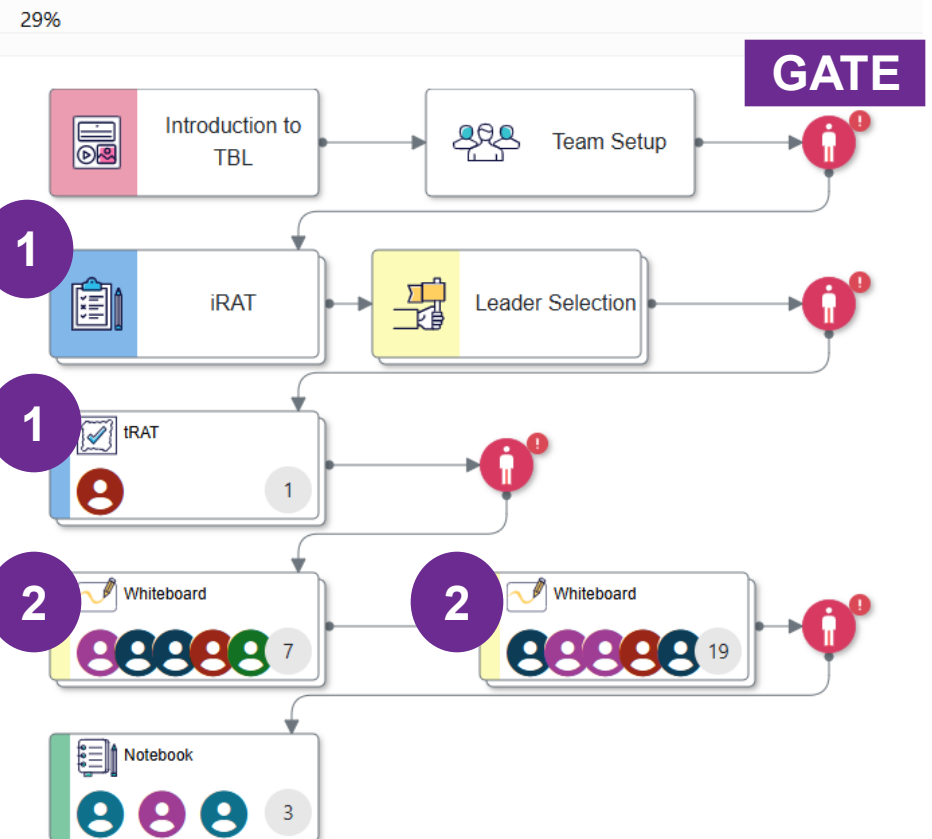
Built like a flow chart with 'gates'

Task 1: A series of MCQs to be undertaken independently (iRAT) then in assigned groups (tRAT)

Task 2: Application exercise(s) based upon content covered that week

MEDN68511 - Practical Microbiology (24/25)

MEDN68511 - Week 2 Bacteriology



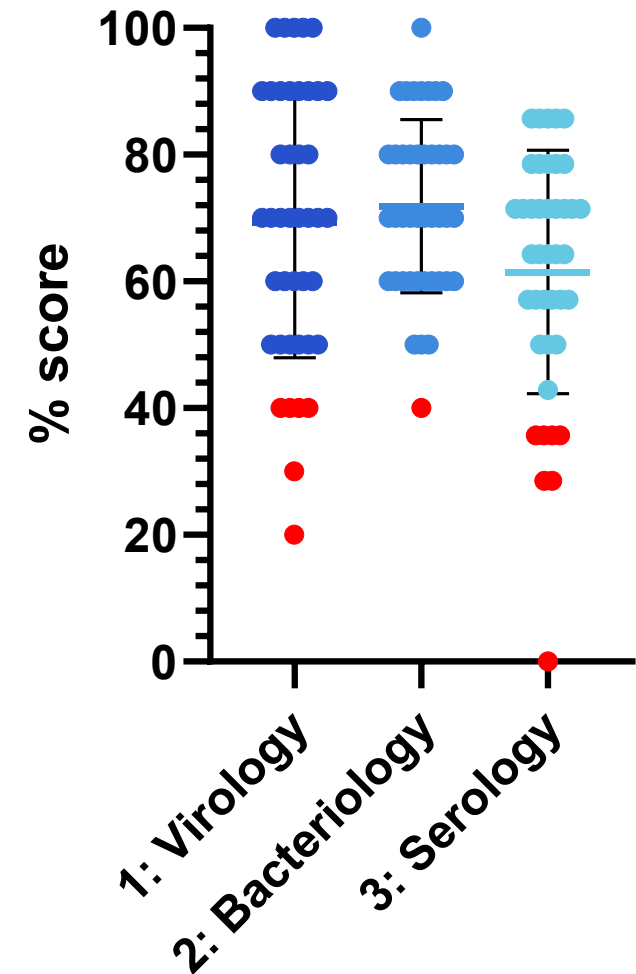
LAMS: MCQs, independent

Assess student scores in real time

Identify candidates that score consistently lower than peers

Graph showing weekly performance on MCQs, where red dots achieved <40%

Can identify students that might need help, very early in the programme

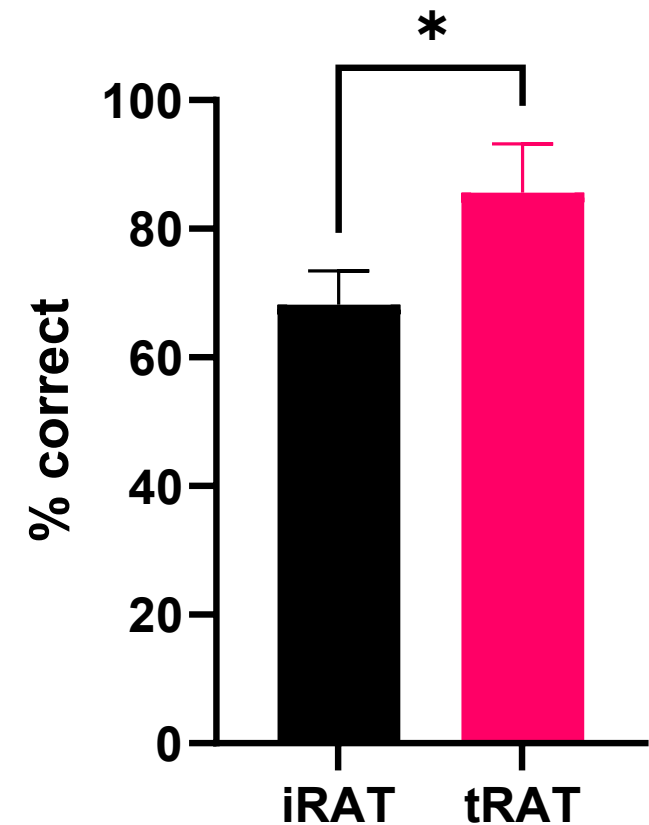


LAMS: MCQs, team-based

After independent completion, students answer the same questions as a team

This enables discussion and reinforces learning

Average scores tend to increase when completed as a team (average over 3 weeks)



LAMS: Application exercises

MCQs showcase knowledge of content but not understanding

Application exercise provide another opportunity to collate complex information

Use LAMS whiteboard function to collate information in groups

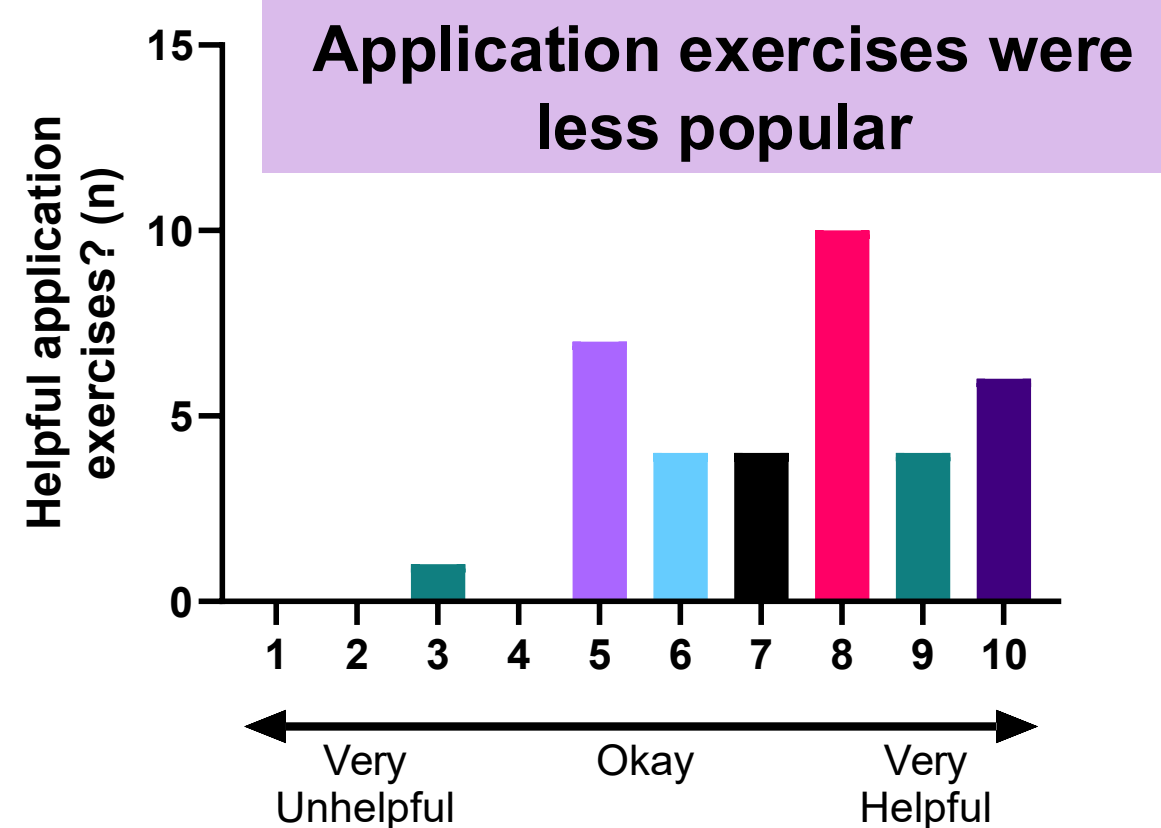
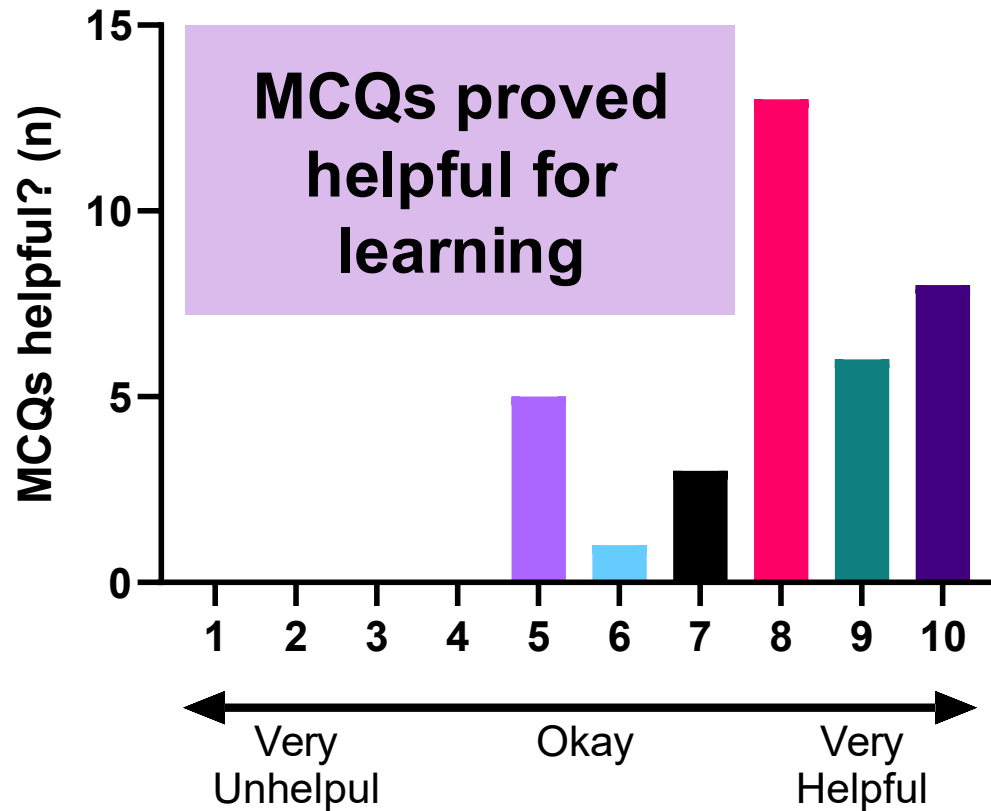
Students asked to summarise information pertaining to specific bacterial species

•	Genus and Species	Agar and colony morphology/characteristics
W	<i>Pseudomonas Aeruginosa</i>	green, metallic,
E	<i>Staphylococcus epidermitis</i>	pink, no yellow agar
L	<i>Staphylococcus aureus</i>	yellow
C	<i>Escheria coli</i>	Pink, lactose fermenter
O	<i>Klebsia pneumonia</i>	pink
M	<i>Streptococcus pneumonia</i>	alpha hemolysis
E	<i>salmonella spp</i>	bright pink, black colonies
☺	<i>moraxella catarrhalis</i>	grey, fastidious

Asked students to identify 8 different bacteria spelling
‘WELCOME ☺’

LAMS: Student opinion

85% of students responded to survey providing opinions on the use of LAMS



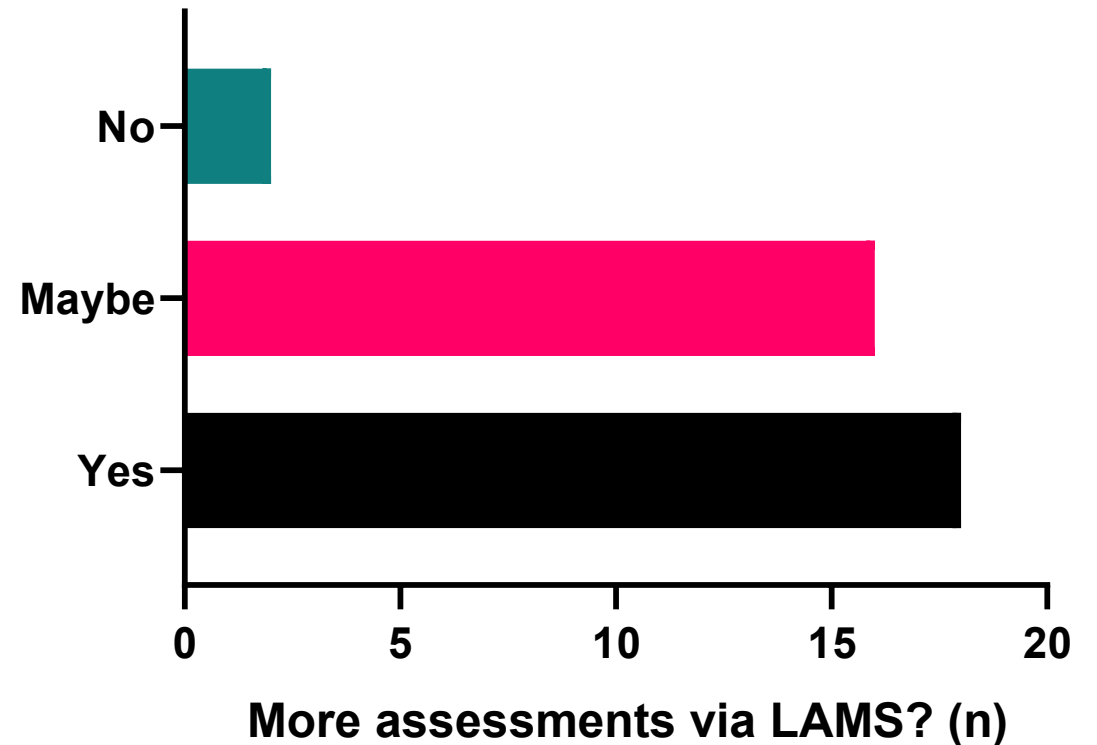
LAMS: Outcomes

Students were generally positive about LAMS

Application exercises require restructuring

50% students wanted more formative assessments on LAMS

We can identify students that require additional support



Digital Resources: Outcomes

Students were positive about incorporation of additional resources

Both LAMS and Rise resources require improvements following student feedback

Continue to improve to enhance student experience!

Thank You!



hannah.serrage@manchester.ac.uk

