Multidisciplinary Simulation Based Learning Enhancement Module

Mayuri Ukidwe, Ashim Datta
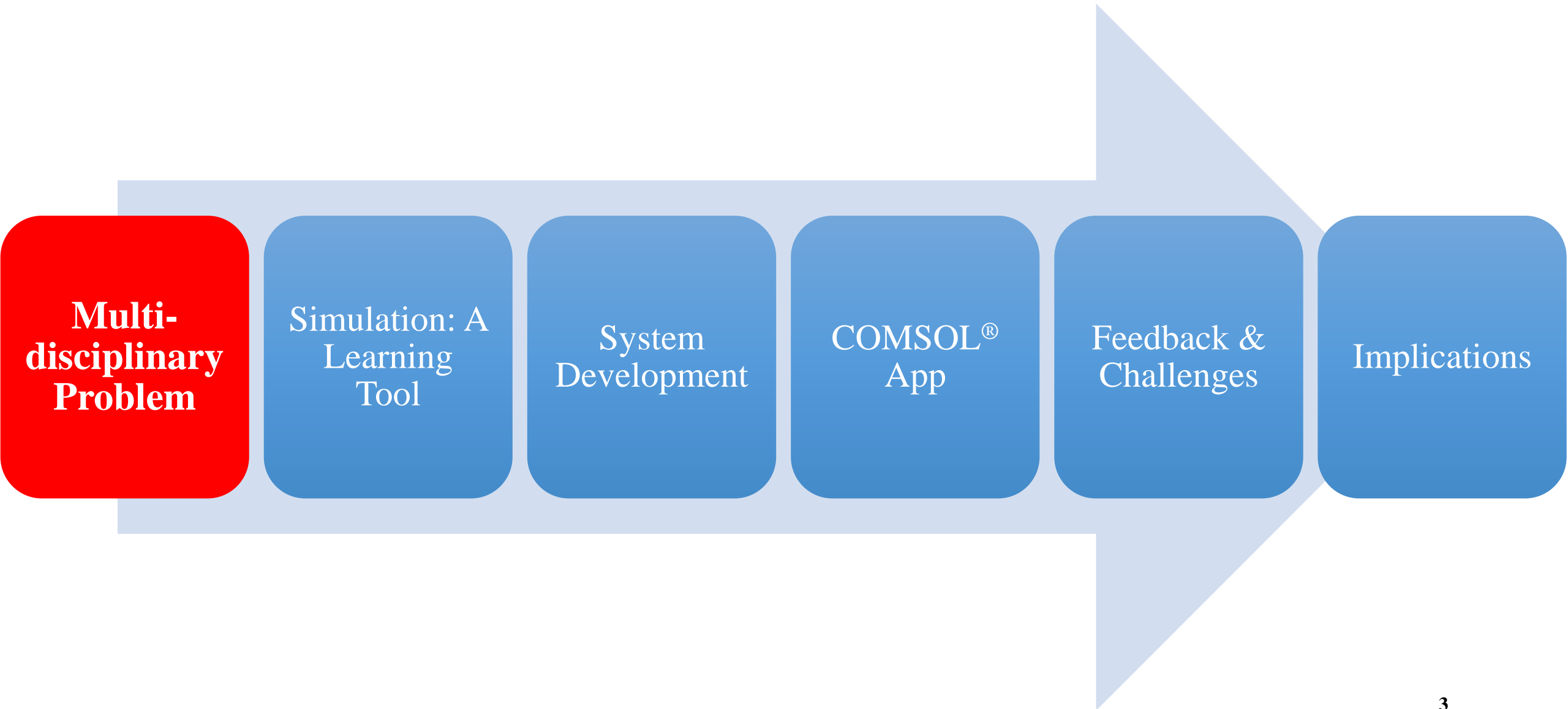
October 04, 2018

COMSOL
CONFERENCE
2018 BOSTON
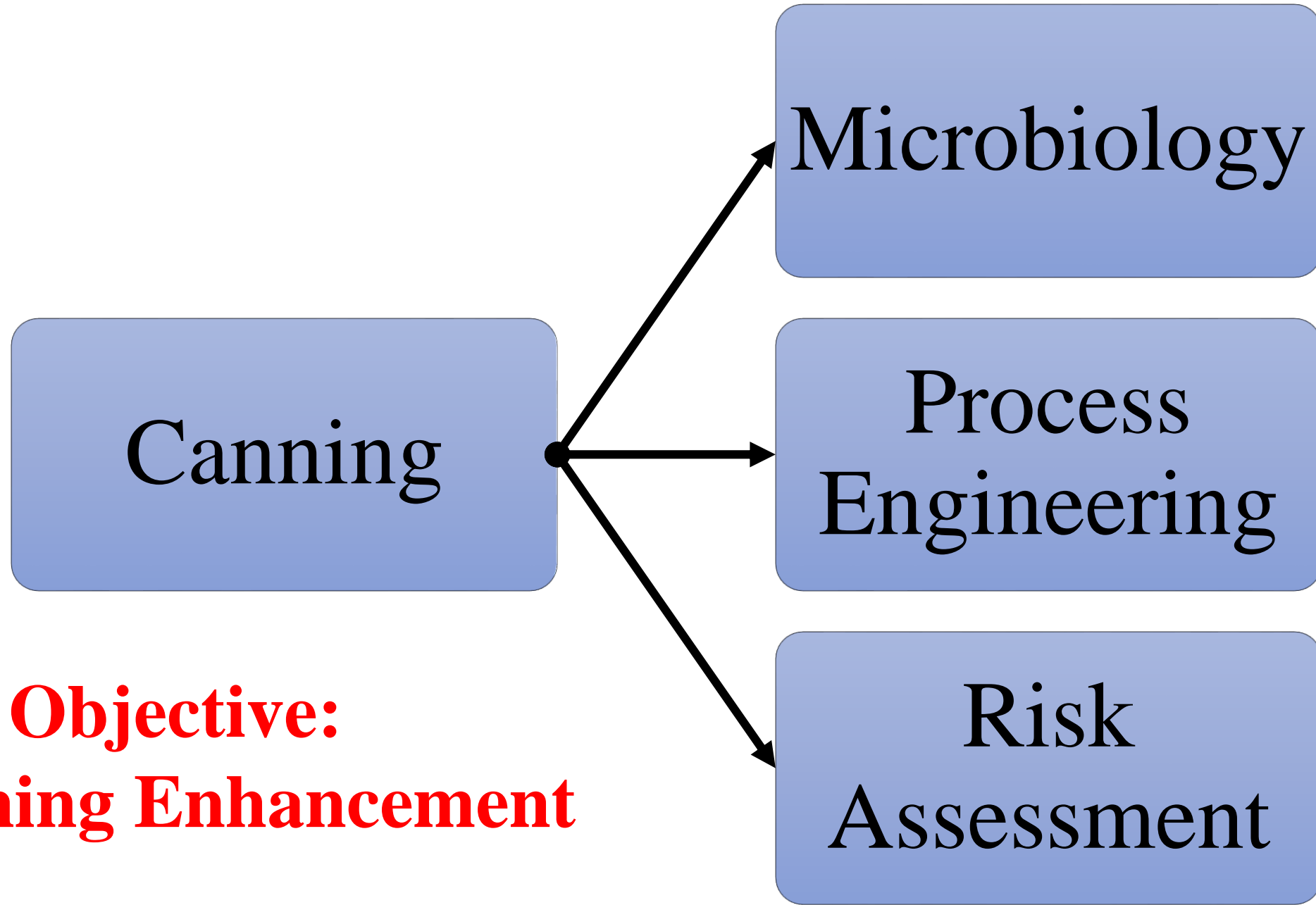
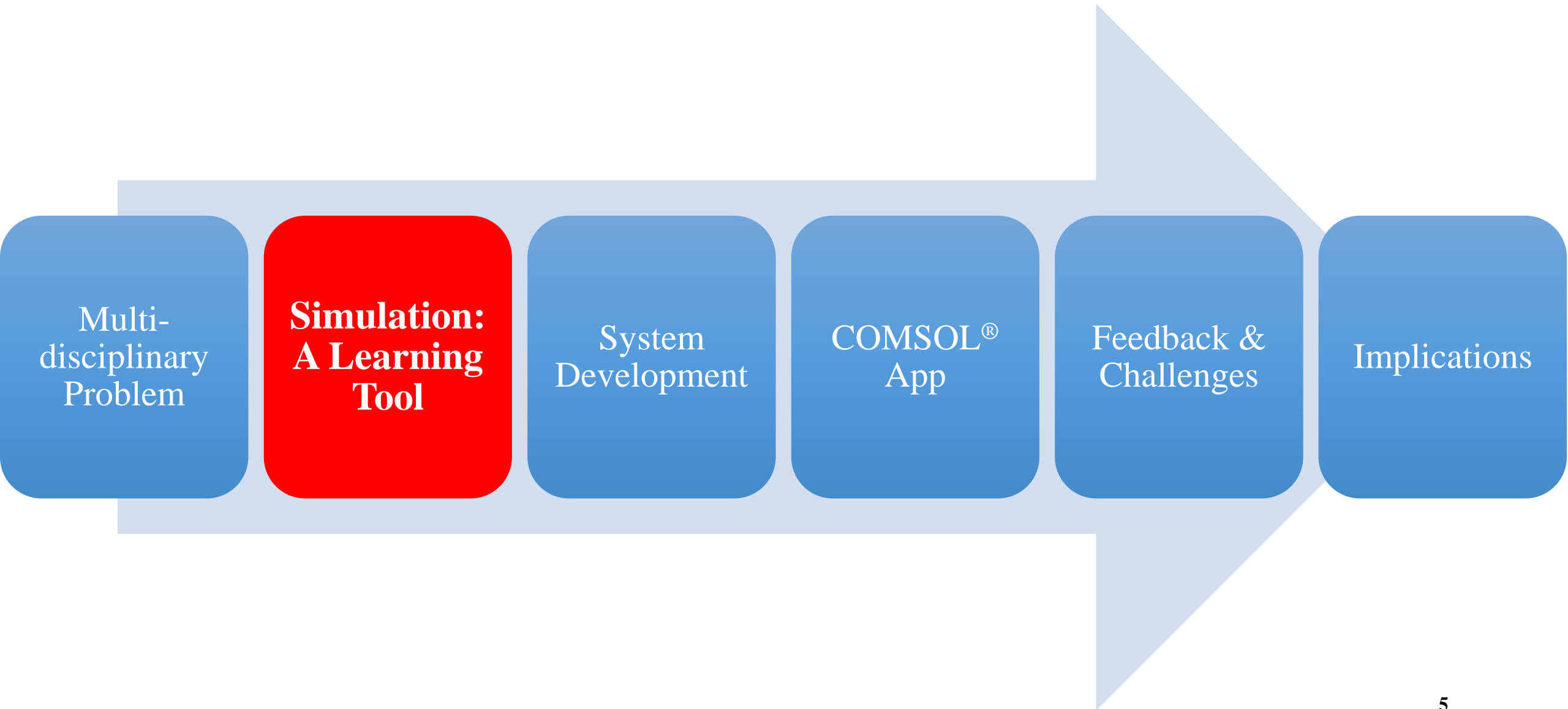# |ACKNOWLEDGEMENTS

CONTENT

| Multi-disciplinary Problem | Simulation: A Learning Tool | System Development | COMSOL® App | Feedback & Challenges | Implications |

FOOD SAFETY: A MULTI-DISCIPLINARY PROBLEM

Main Objective: Learning Enhancement

CONTENT

Multi-disciplinary Problem

Simulation: A Learning Tool

System Development

COMSOL® App

Feedback & Challenges

Implications

SIMULATION: NEARLY 90% RETENTION
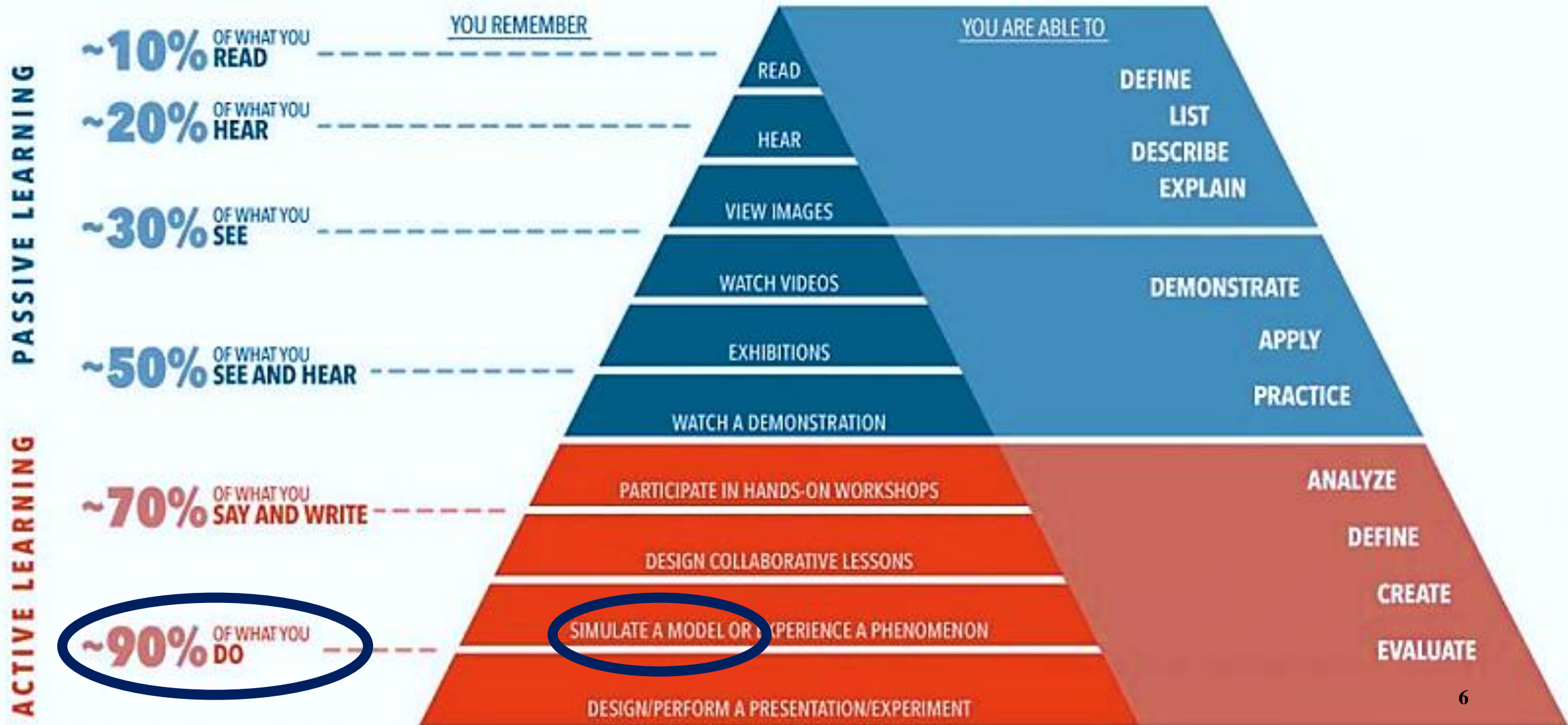
OTHER ADVANTAGES

❖Individual Pace

❖Distance Learning

❖Safe place to fail

❖Complimentary to Lab

CONTENT
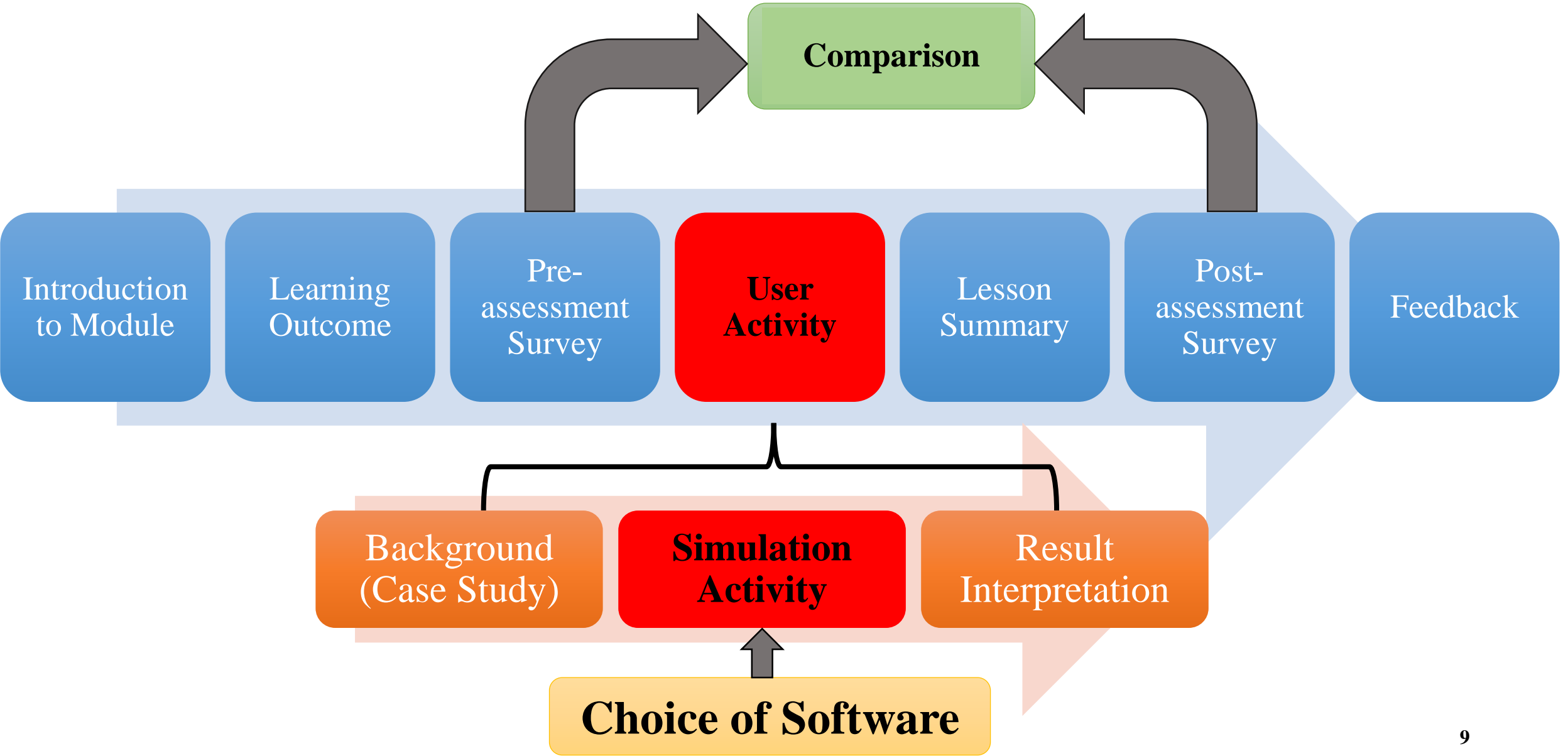

Multi-disciplinary Problem | Simulation: A Learning Tool | System Development | COMSOL® App | Feedback & Challenges | Implications

LEARNING MODULE

Comparison

Introduction to Module

Learning Outcome

Pre-assessment Survey

User Activity

Lesson Summary

Post-assessment Survey

Feedback

Background (Case Study)

Simulation Activity

Result Interpretation

Choice of Software

9

SIMULATION ACTIVITY: SOFTWARE CHOICE

Capabilities of software

Ease of utilization

Cost of implementation

Ease of development

Microbiology

- Excel

Process Engineering

- COMSOL Multiphysics®

SIMULATION ACTIVITY: SOFTWARE CHOICE

Capabilities of software
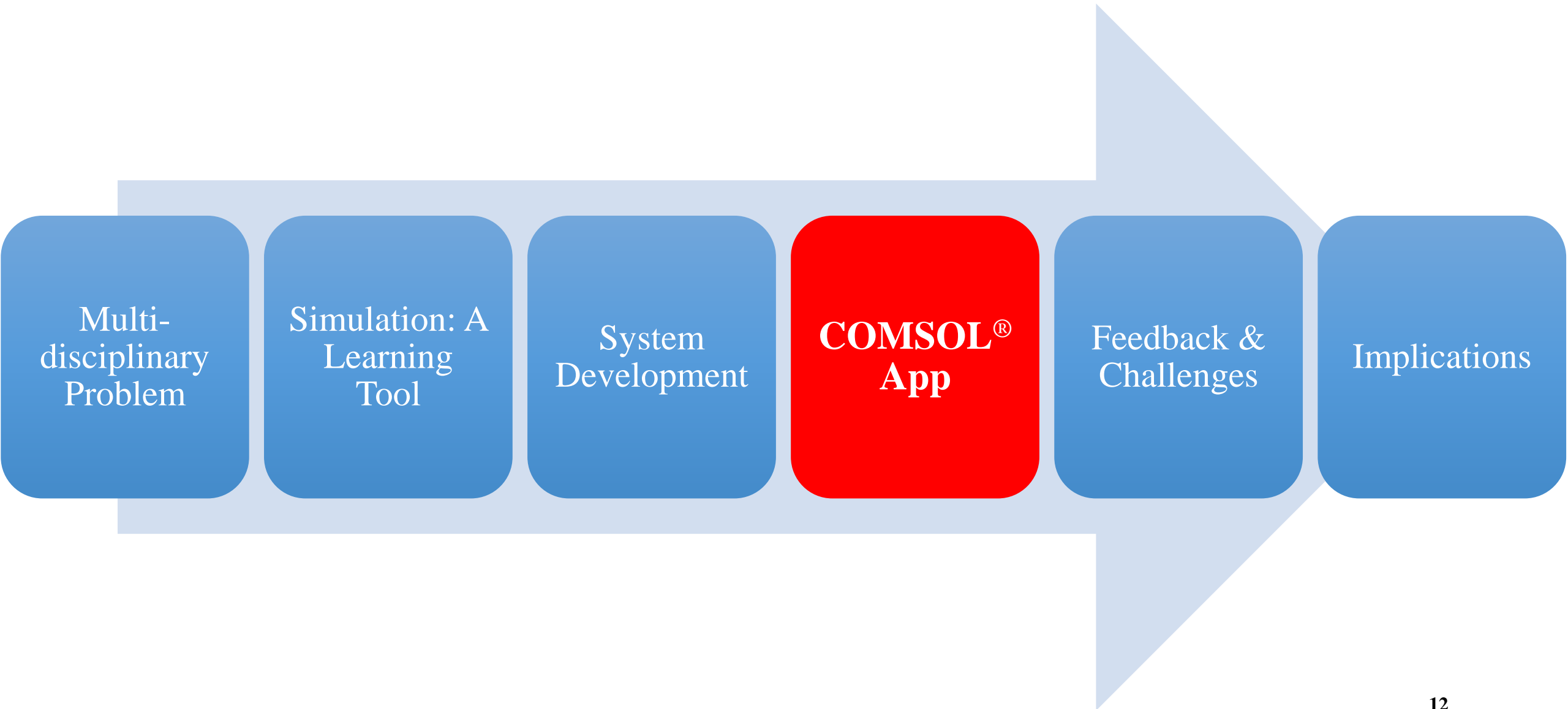
Ease of utilization

Cost of implementation

Ease of development

Microbiology

- Excel

Process Engineering

- COMSOL Multiphysics®

Risk Assessment

- R, @Risk

CONTENT

Multi-disciplinary Problem | Simulation: A Learning Tool | System Development | **COMSOL® App** | Feedback & Challenges | Implications

COMSOL® APP: CANNING **Heating of a can containing solid food**

Can radius: 4cm

Can height: 8cm
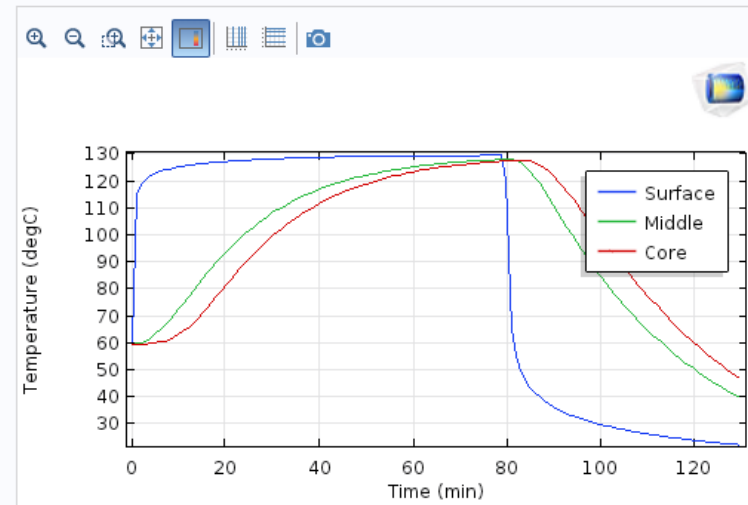
Canning time: 80min

Canning temperature: 130⁰C
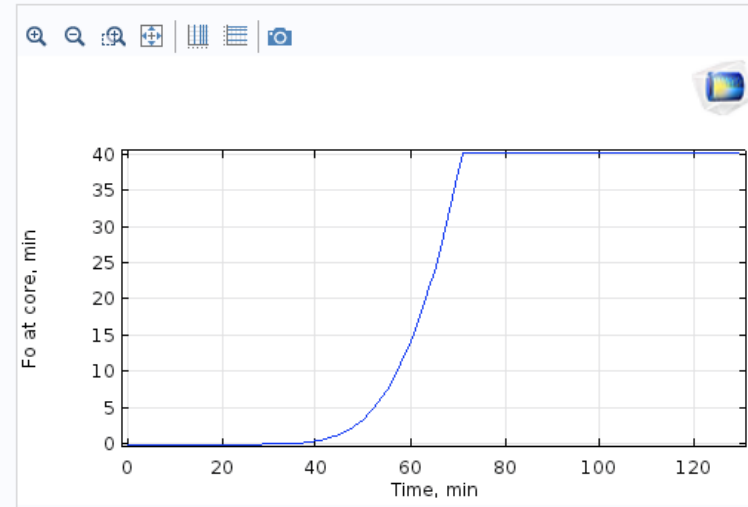
How many bacteria died?

Heat transfer in solids

ODE and DAE interfaces,

Application builder and

COMSOL Server™

COMSOL SERVER™

8 GB memory

Up to 5 instances

3-4 per instance

Red Cloud Computing

COMSOL Server™ 5.3a

Class size and time

RESULTS % INCREASE

19 %
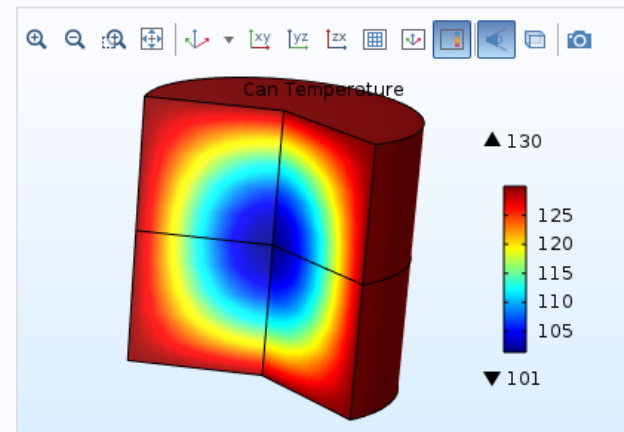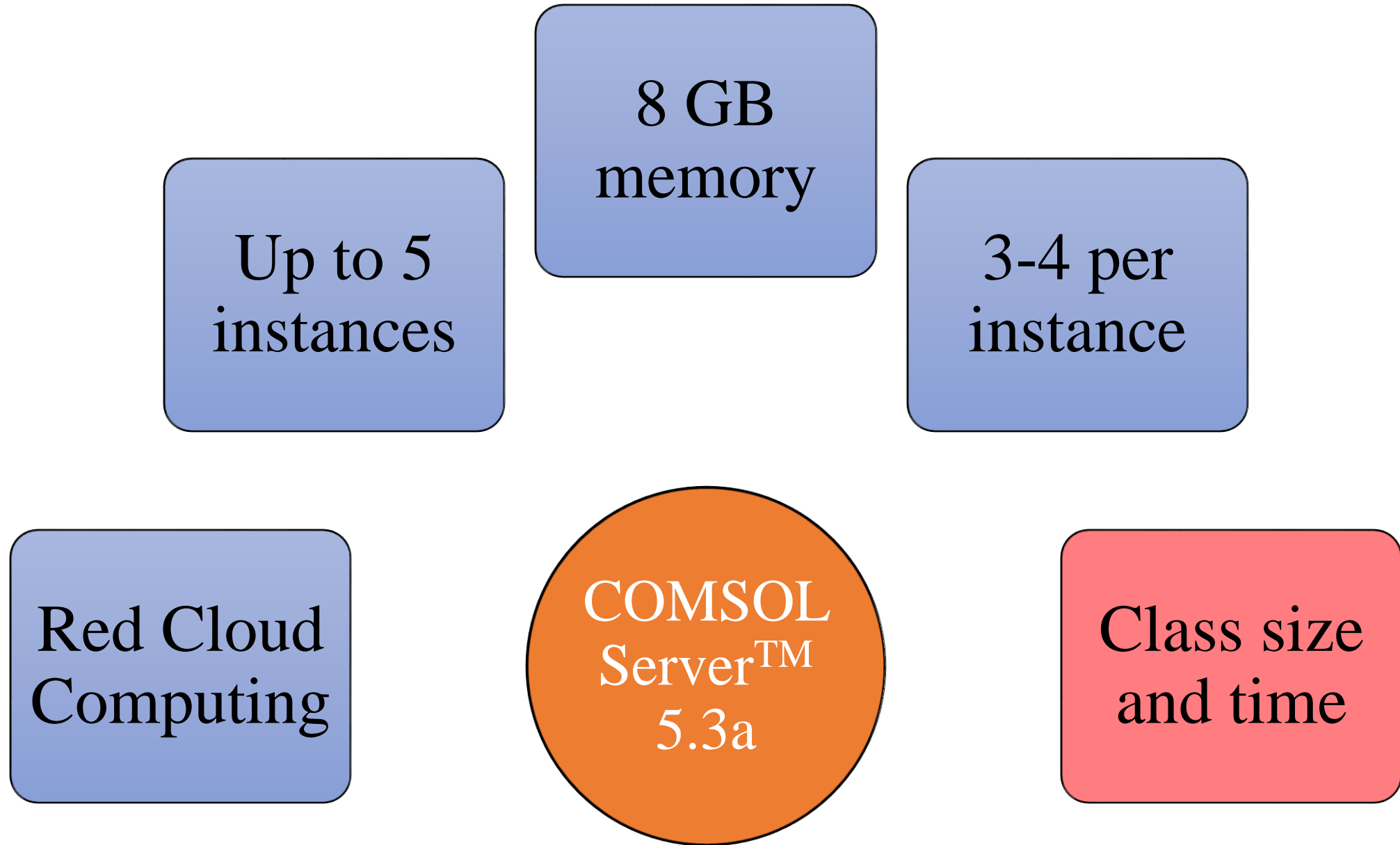
- Pre-assessment
- Post-assessment

MSU Spring 2018

UGA Spring 2018

UCD Spring 2016

UCD Fall 2016

Cornell Fall 2016

UCD Fall 2017

UIUC Fall 2017

% Correct Answers

100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
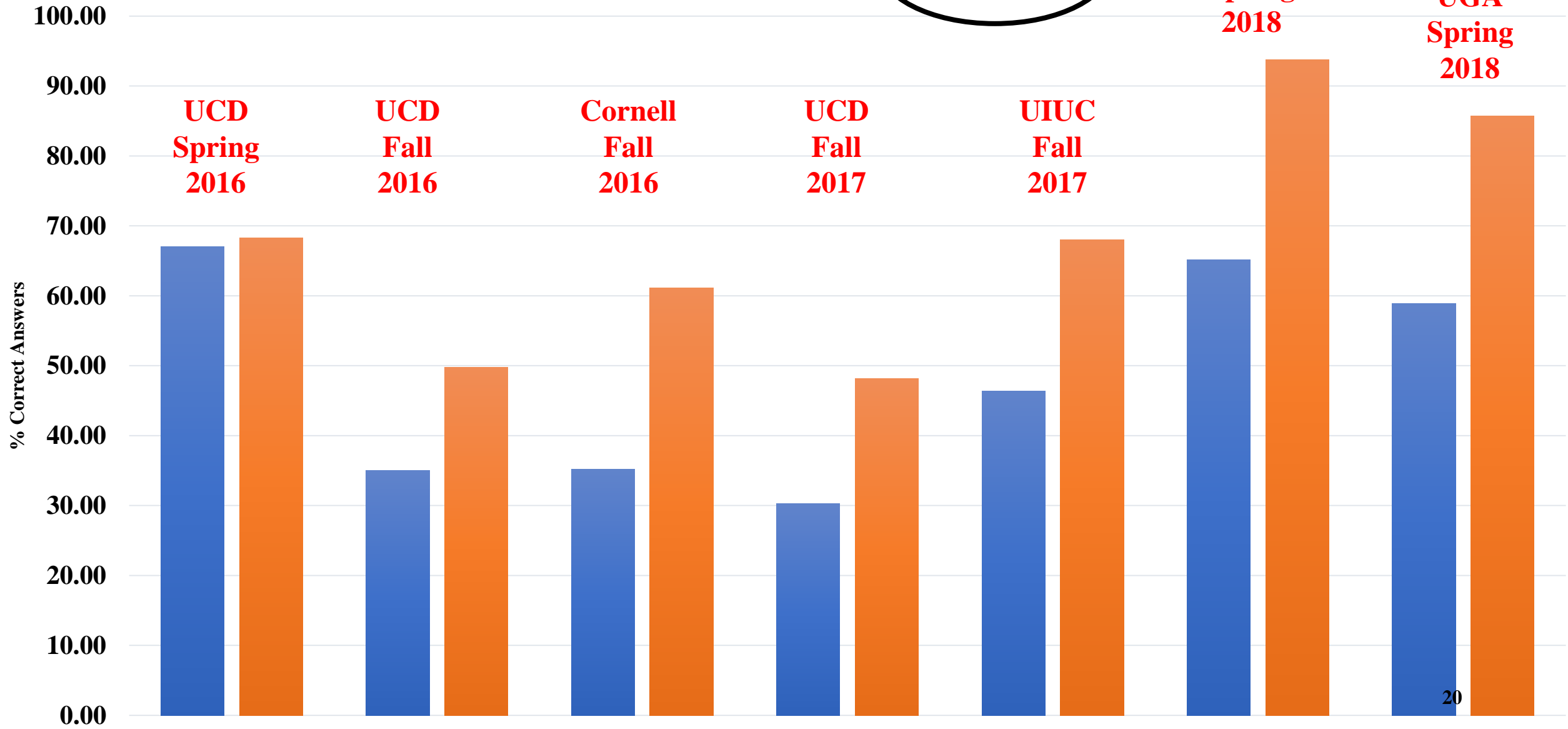
20
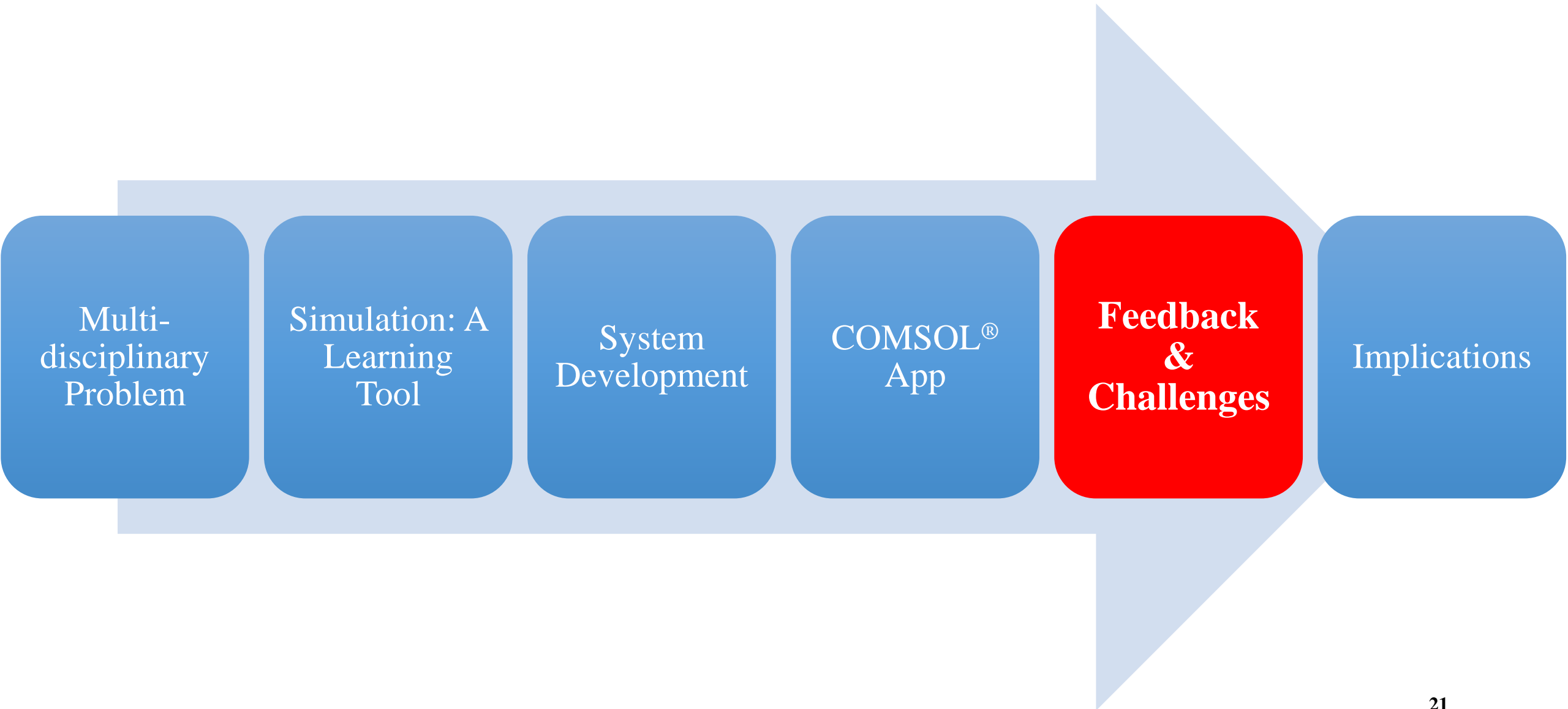
CONTENT

STUDENTS' FEEDBACK

80 %

Very or Somewhat useful

20 %

Not at all useful

RELATED TO THE COMSOL® APP
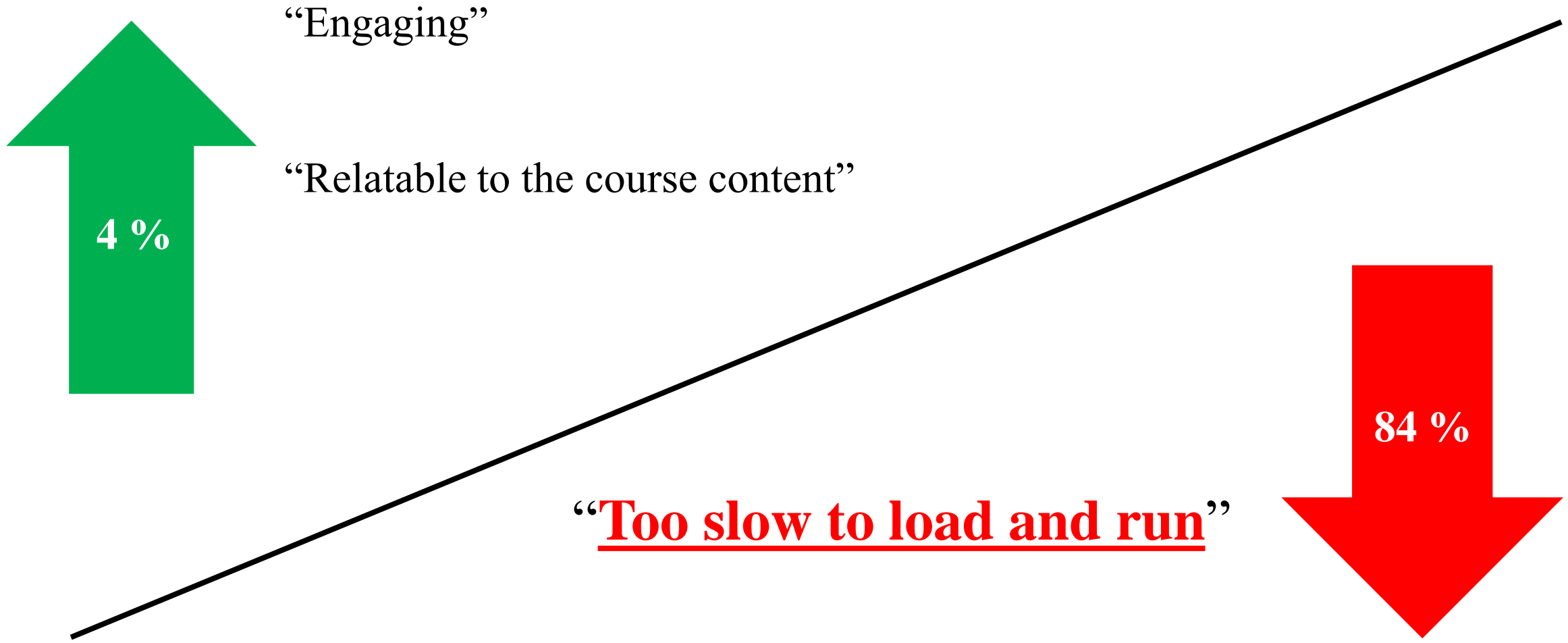
"Engaging"

"Relatable to the course content"

4 %

84 %

"**Too slow to load and run**"

DEVELOPER'S CHALLENGES

❖ **App development cost**

- COMSOL Multi-physics$^{®}$ product

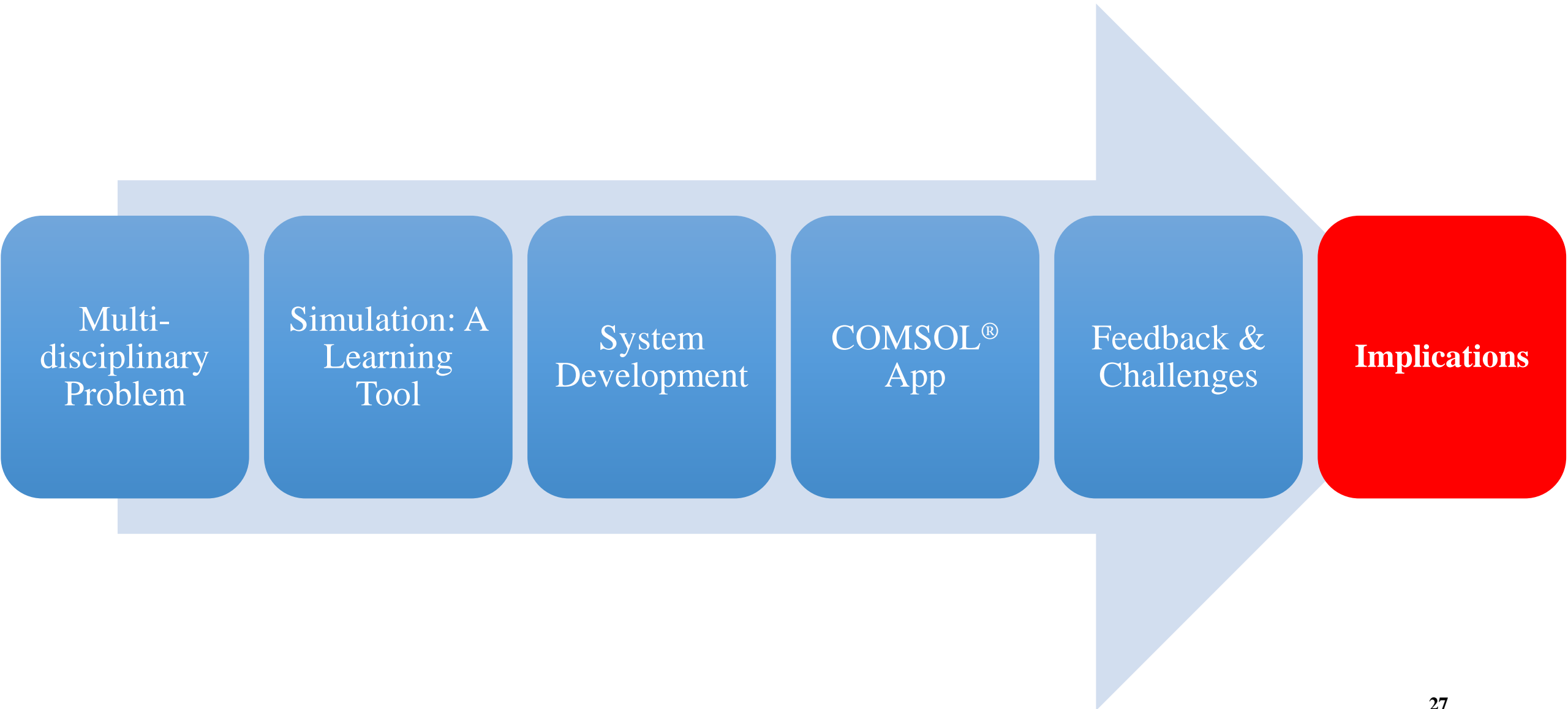- COMSOM Server^{TM} License cost

- Update

❖ **Running cost**

- Bigger instance : double cost

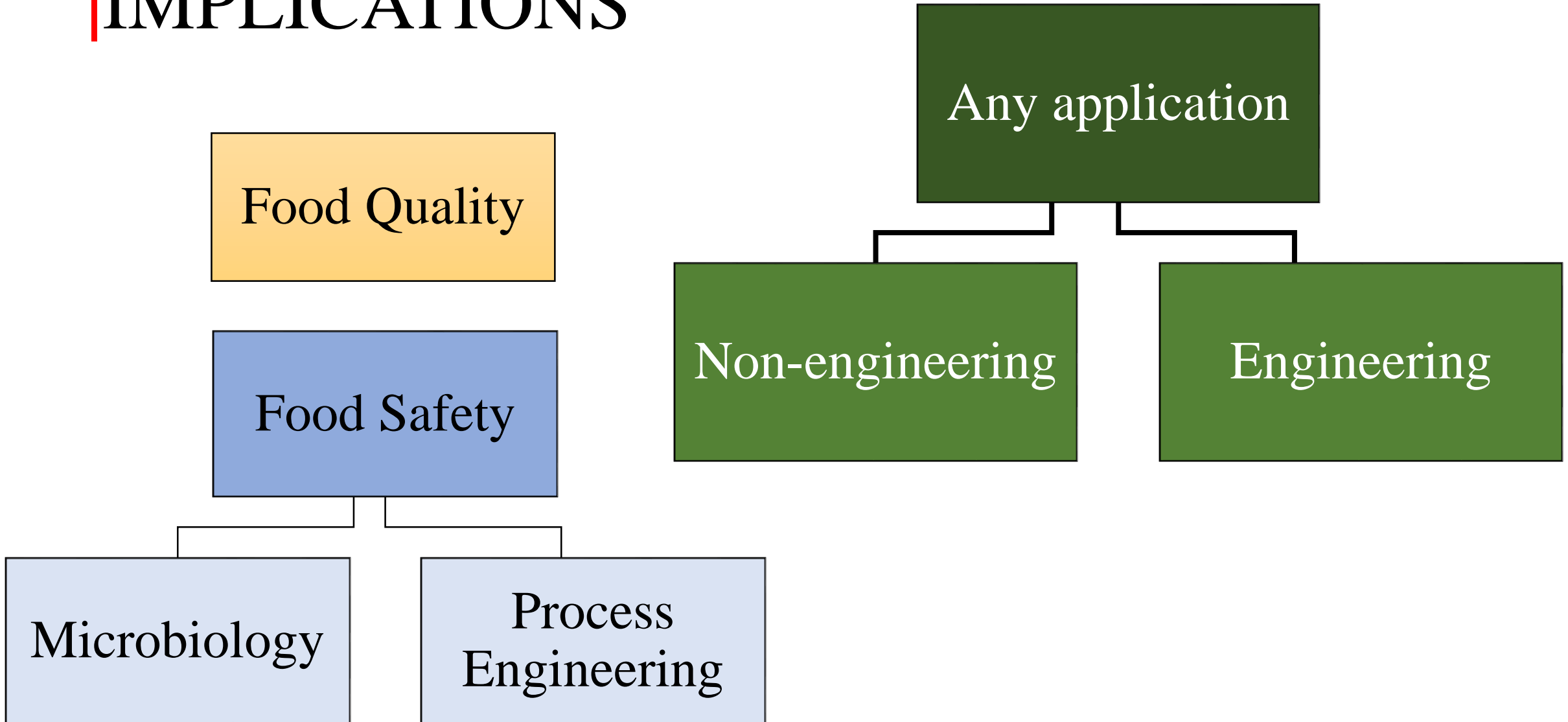- $ 0.05 per hour

- Large class, 1 week, $50

No direct financial output from educational use!

Complementary COMSOL Server^{TM} for classroom use?

26

CONTENT

IMPLICATIONS

Thank you

Questions?

http://blogs.cornell.edu/edusim/

———

Ashim Datta (akd1@cornell.edu)
Mayuri Ukidwe (msu5@cornell.edu)

COMSOL CONFERENCE 2018 BOSTON