

# Wet and dry approaches to enhancing contextual understanding of pharmacokinetics in UG and PG teaching



SJ Tucker

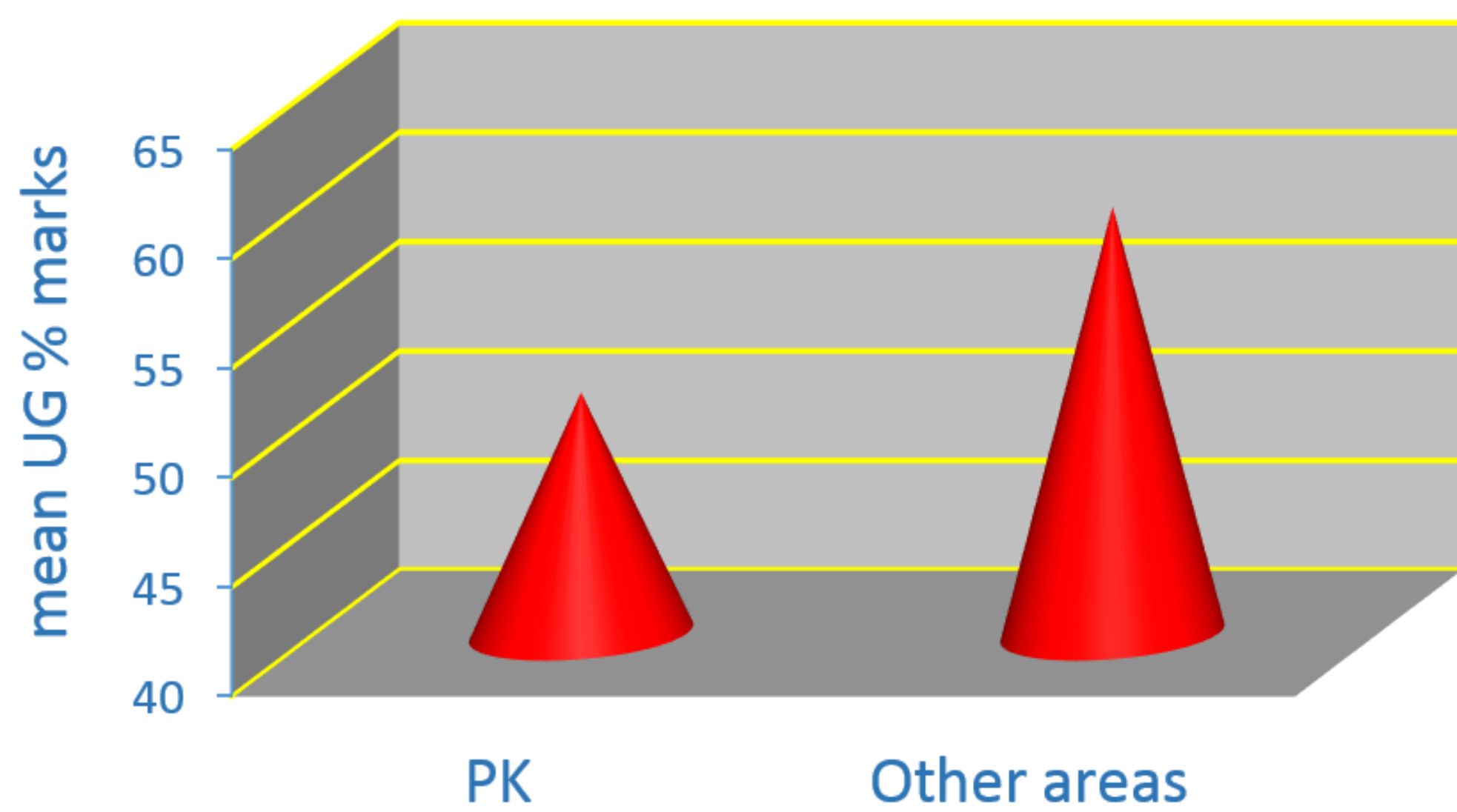


School of Medicine, Medical Sciences & Nutrition, University of Aberdeen

## Background context

- Pharmacokinetics is a key curricular area in UG and PG programmes.
- Traditionally, students struggle to cope with the material, particularly in making the connection between the numbers and their *in vivo* meaning.
- Students perform less well in the pharmacokinetics assessments compared to other areas of the course.

UG student performance in PK assessments compared to others



- UG/PGT feedback shows new approaches are required:
  - “pharmacokinetics is hard”
  - “pharmacokinetics teaching was archaic”
  - “couldn’t engage with the PK material, just didn’t see the connection”
- Educators find teaching PK challenging; traditional approaches are outdated and dry.

## Aim

- To enhance the quality and effectiveness of PK teaching and learning at PG and UG level using 2 key strands:

### Blackboard to Benchtop:

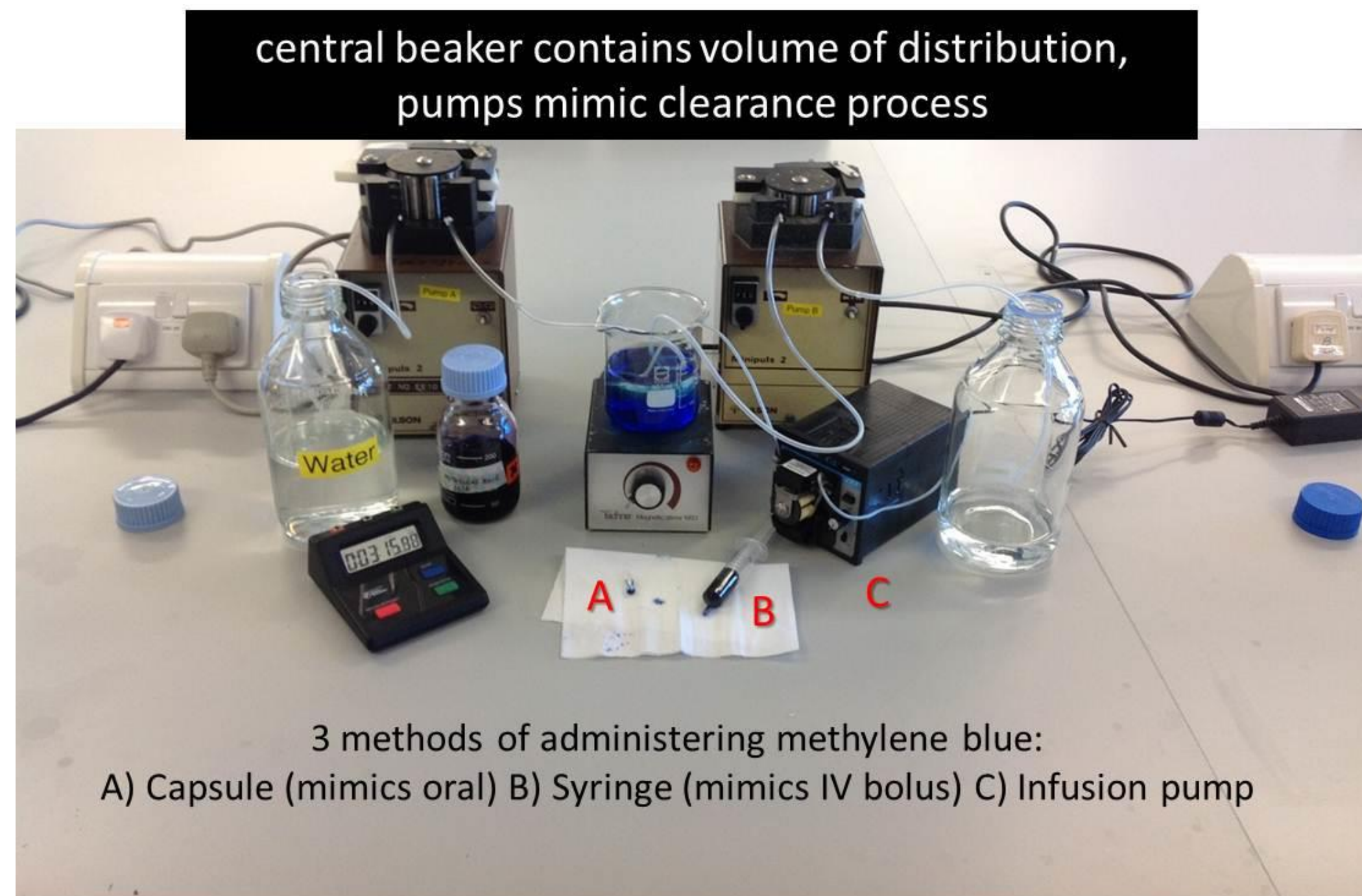
- To design a series of practical exercises that bring pharmacokinetics to life.

### Benchtop to Laptop:

- To transform these practical exercises into flexible online simulations.

## Blackboard to benchtop

- Attempted to make PK teaching more applied and interactive rather than didactic.
- A series of practical exercises were designed utilising a simple model system.
- The system models elimination of methylene blue (the “drug”) from a central volume (the volume of distribution,  $V_d$ ) using peristaltic pumps (the clearance,  $CL$ ).



3 methods of administering methylene blue: A) Capsule (mimics oral) B) Syringe (mimics IV bolus) C) Infusion pump

The apparatus used to model pharmacokinetic processes in class practicals. This has created a novel, interactive and innovative way of teaching the subject and allowing students to bring the numbers to life.

- Use of model system in timed experiments generates concentration time data (standard curve quantifies concentration).

## A suite of practical exercises

### Potential applications modelled:

- Single dose
- Multiple doses
- Continuous infusion

### Potential routes of administration modelled:

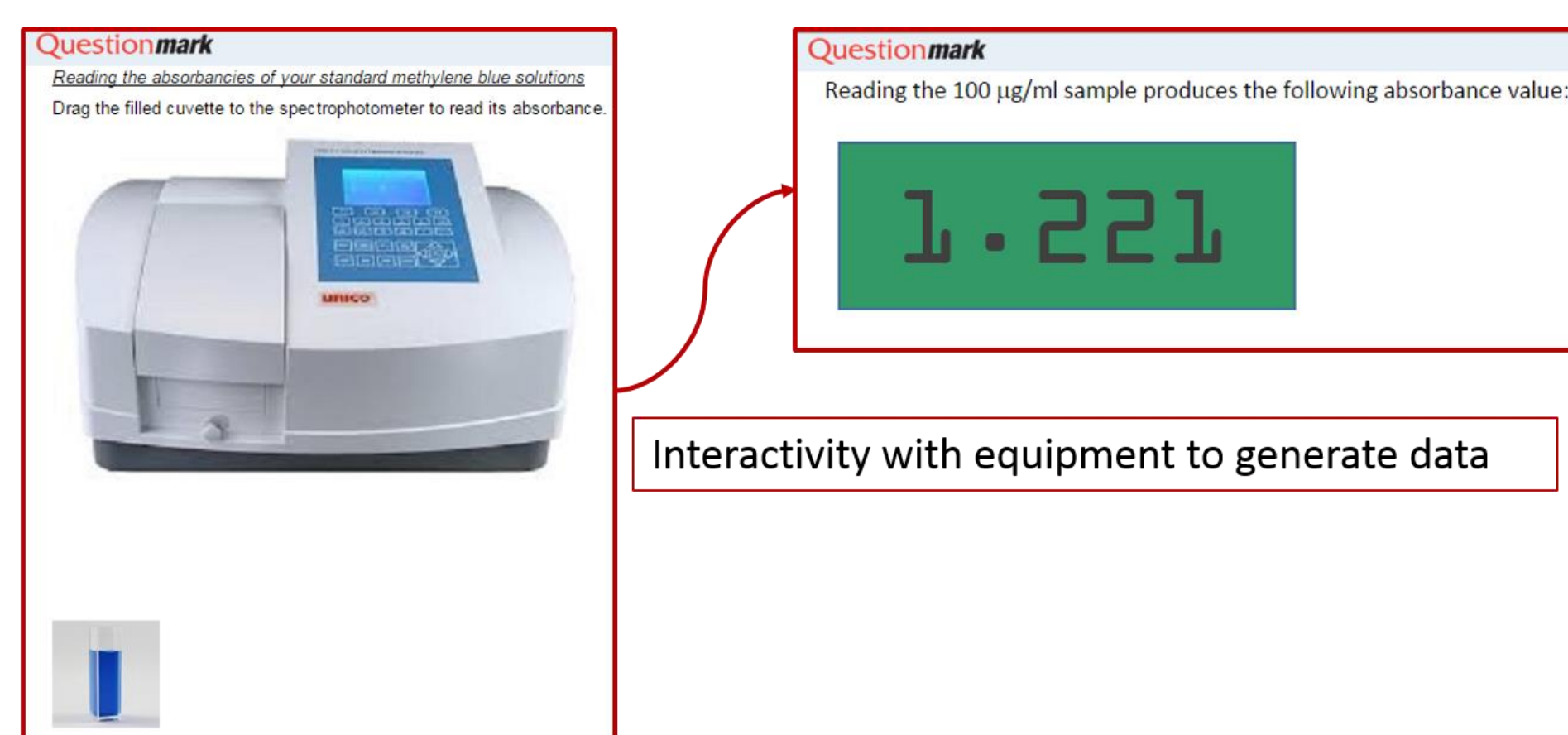
- IV bolus injection
- IV line
- Oral

### Potential PK parameters varied / investigated:

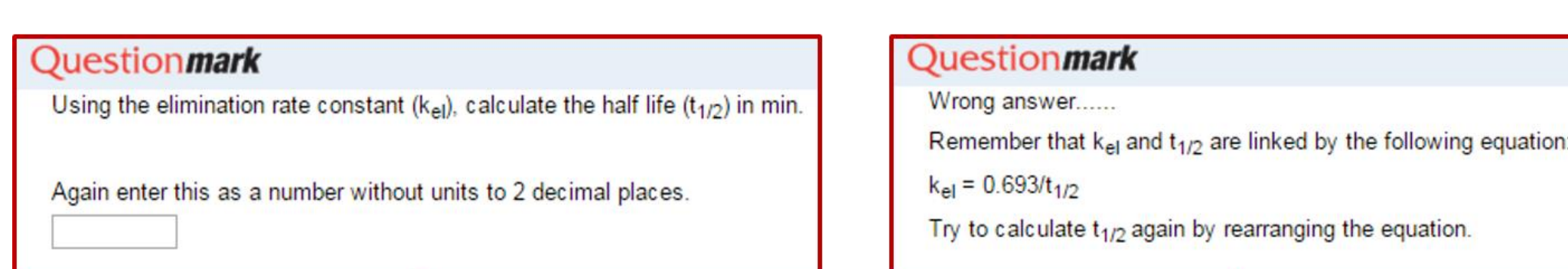
- Dose size
- Dose frequency
- Maximum concentration
- Time to maximum concentration
- Clearance
- Volume of distribution
- Time to steady state
- Loading dose

## Benchtop to laptop

- Migration of these practical exercises into an online simulation package furthers flexibility and accessibility.
- Utilised assessment software to map practical exercises into interactive experiential feedback loops:



Interactivity with equipment to generate data



Instructive feedback to build experience and understanding

## A suite of flexible online exercises

- Same range of variables available as with the practicals, with delivery highly flexible:

### Flexibility of delivery:

- Tutorial
- Interactive lecture
- Simulated practical
- Revision tool (unlimited open access available)
- Assessment tool (secure access available)

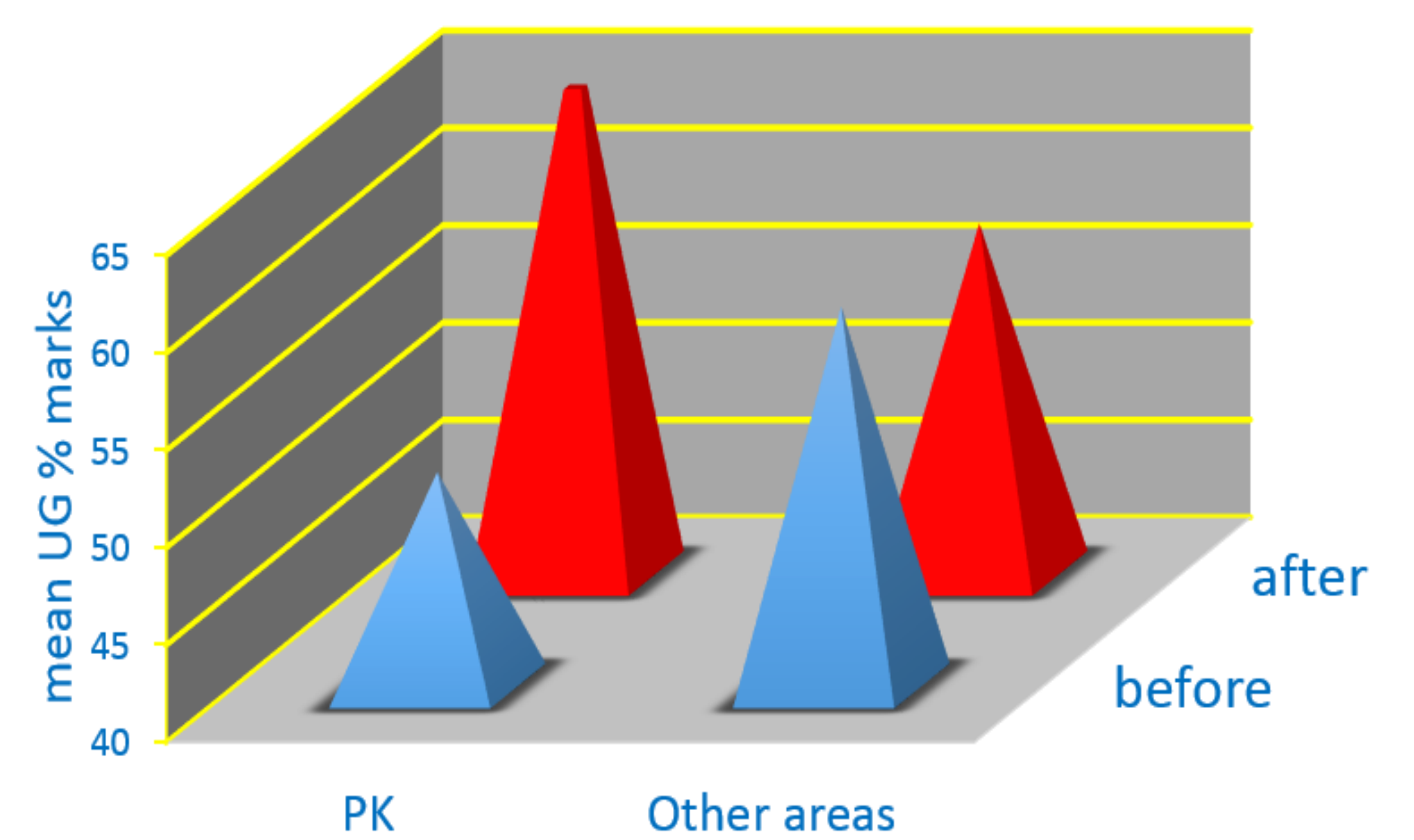
## Evaluation

- Feedback (improved):

“Really useful for understanding concepts”
“clear and useful”
“I better understood the concepts when I was doing the lab work and writing up the report”
“they helped in understanding the theoretical part of the course”

- Grades (improved):

UG performance in PK assessments compared to other areas before and after use of new approaches



## Outcomes

- These resources address some of the issues surrounding effective PK teaching and learning.
- They involve a catalogue of tangible exercises that require application of understanding in a visual and interactive way.
- Such approaches are clearly more engaging and effective in teaching students; and so enhance the Pharmacology student experience.
- The flexibility of these approaches increases their reach across HEIs and their potential for use in other curricular areas.
- Supported by a BPS teaching grant.