

# MEASURING STUDENT ENGAGEMENT AND PARTICIPATION: HOW CAN AN ENGINEERING LECTURER'S USE OF TECHNOLOGY IN TEACHING AND LEARNING CONTRIBUTE TOWARDS INSTITUTIONAL RESEARCH?

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# Aims

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- to present a small-scale educational research project and its findings, particularly the impact this has had on engineering students and lecturer
- to explore if and how such small-scale efforts can be used to inform institutional level research and in defining the metrics for TEF.

# What are clickers?

- Personal response system or clickers allows real time voting over a question posed in a lecture
- Polling is anonymous
- Encourages student participation

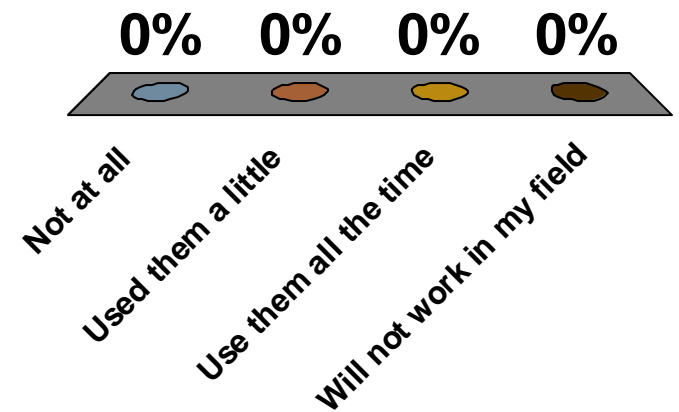
Channel/Go

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Channel/Go

# Have you used clickers in your teaching?

- A. Not at all
- B. Used them a little
- C. Use them all the time
- D. Will not work in my field



# Challenges in using 'clickers' effectively

## What is the pedagogy?

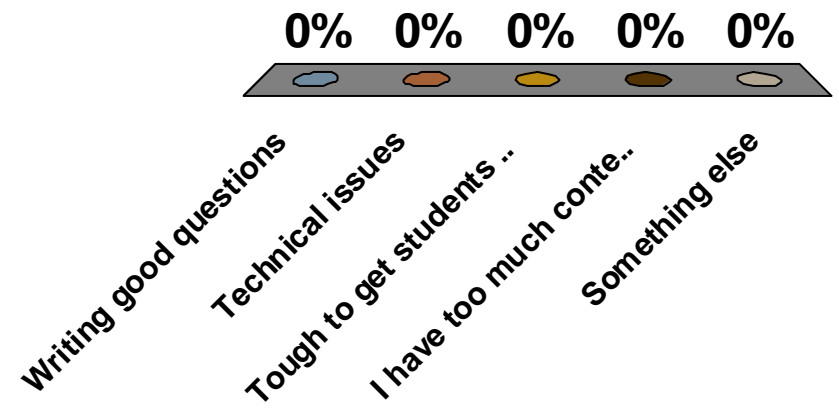
- Learning outcomes of a lecture – how to do we measure them?
- How many times do the students volunteer to ask questions?
- How many times do the student answer to a question posed to them during a lecture?

*But we learn by questioning and discussing*

Embedding technology e.g. 'clickers' can enhance the learning and teaching experience

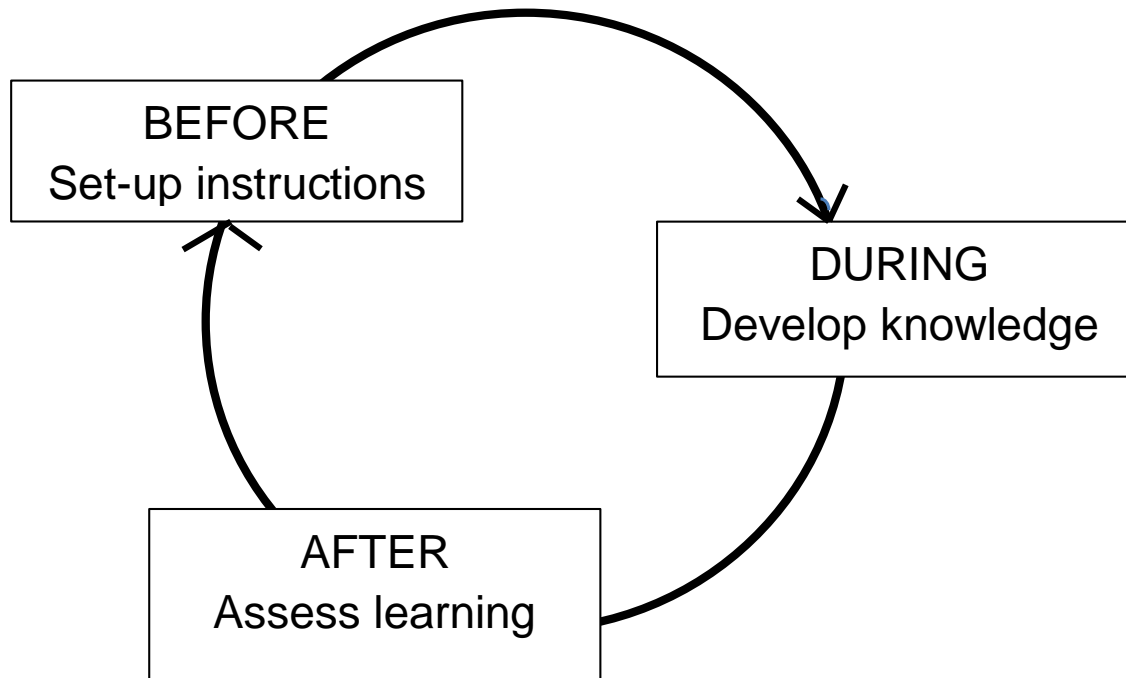
# Which do you think is the most common challenge cited by teachers?

- A. Writing good questions
- B. Technical issues
- C. Tough to get students to discuss questions
- D. I have too much content to cover / takes too much time
- E. Something else



# Challenges in using 'clickers' effectively

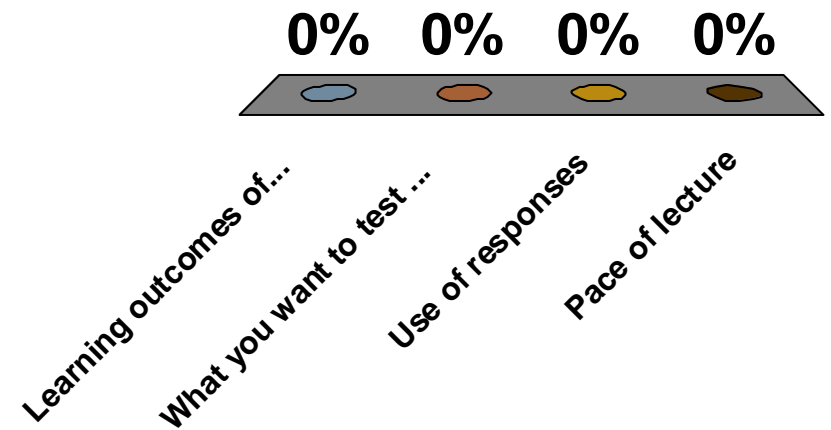
## Question cycle<sup>1</sup>



<sup>1</sup>Designing effective questions for classroom response system teaching Ian D. Beatty, a William J. Gerace, William J. Leonard, and Robert J. Dufresne Am. J. Phys., Vol. 74, No. 1, January 2006.

# Before setting the question what you need to consider

- A. Learning outcomes of the session
- B. What you want to test e.g. knowledge/skills
- C. Use of responses
- D. Pace of lecture





# Content re-design: Question design aims

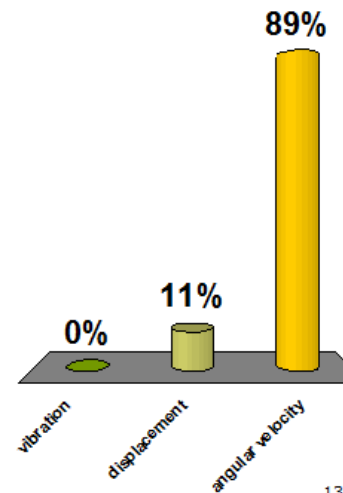
- Define question around the learning outcomes
  - ▣ Skills and/or concepts
- Identify goals of the clicker question
  - ▣ Promote articulation/discussion, stimulate cognitive processes
- Choose type of question to use
  - ▣ Qualitative question, analysis and reasoning, interpret representation, rank variants

# 3<sup>rd</sup> year Instrumentation & Control

## Challenges in writing a question (knowledge-based)

MCQ1 - Tachometers are used in order to measure

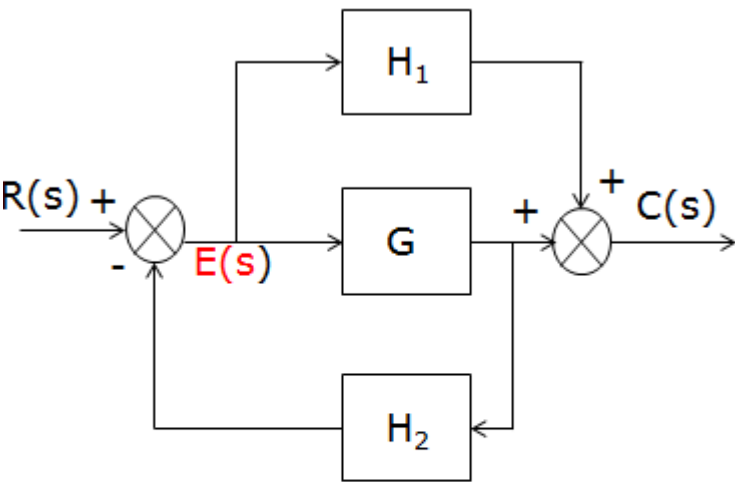
- A. vibration
- B. displacement
- C. angular velocity



- Immediate feedback on student learning
- 89% got it right

# 3<sup>rd</sup> year Instrumentation & Control

## Challenges in writing a question (skill-based)



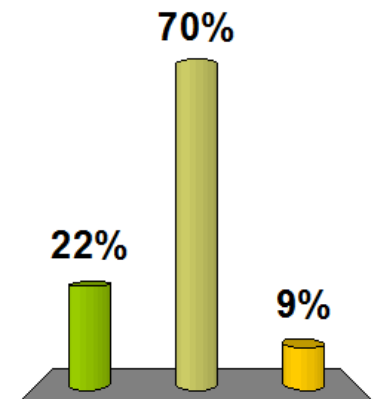
Step 1: write the equations

Find  $\frac{C(s)}{R(s)}$

- Immediate feedback on student learning
- Only 9% got it right

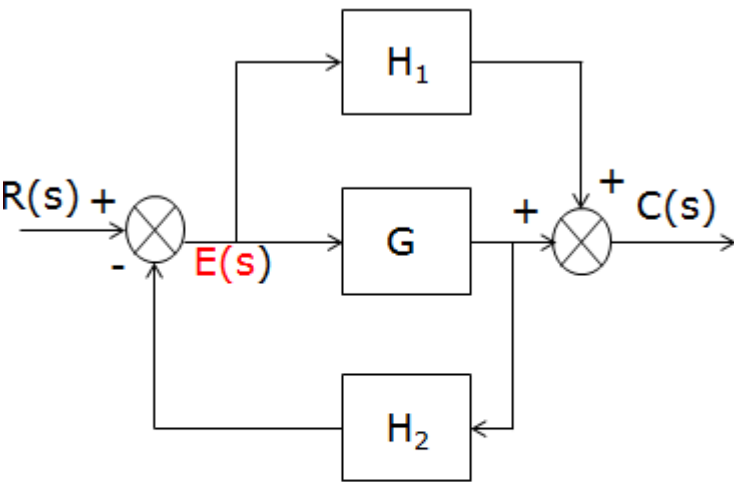
MCQ1 – The first equation is

- A.  $E(s) = R(s) - H_2$
- B.  $E(s) = R(s) - GH_2$
- C.  $E(s) = R(s) - E(s)GH_2$



# 3<sup>rd</sup> year Instrumentation & Control

## Challenges in writing a question (skill-based)

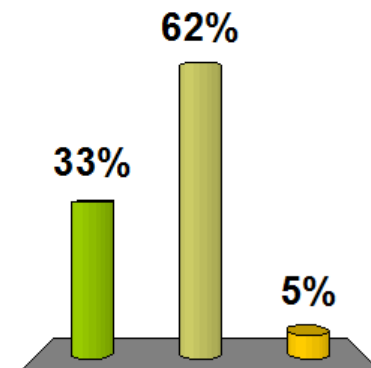


Step 1: write the equations

Find  $\frac{C(s)}{R(s)}$

MCQ2 – The second equation is

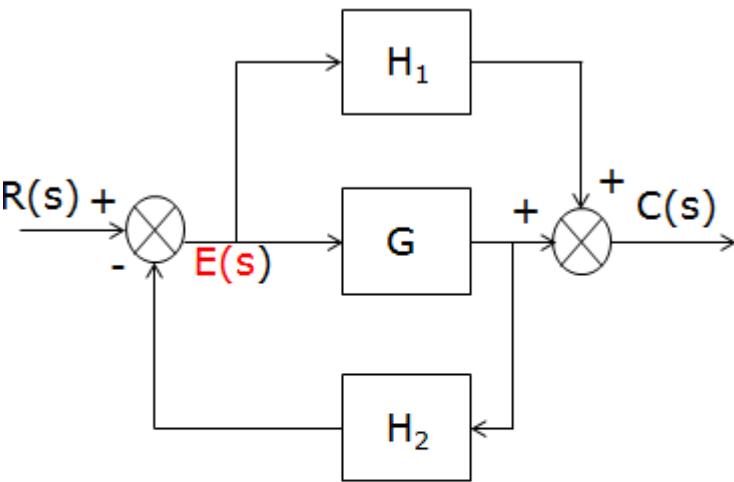
- A.  $C(s) = E(s)G + H_1$
- B.  $C(s) = E(s)G + E(s)H_1$
- C.  $C(s) = E(s)G - E(s)H_1$



- Peer learning + clickers = higher attainment
- Initiates discussion
- 62% got it right

# 3<sup>rd</sup> year Instrumentation & Control

## Challenges in writing a question (skill-based)



MCQ3 -  $\frac{C(s)}{R(s)}$  is

A.  $\frac{H_1+G}{1+GH_2}$

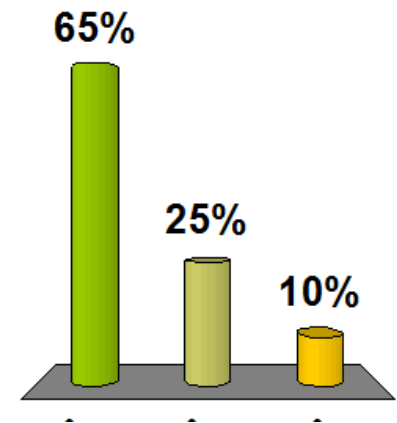
B.  $\frac{H_1G}{1+GH_2}$

C.  $\frac{H_1+G}{1+GH_1H_2}$

Step 1: write the equations

Find  $\frac{C(s)}{R(s)}$

65% got it right

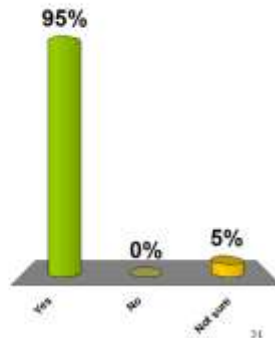


# What do the students think?

## Clickers enhanced students understanding of Instrumentation and Control

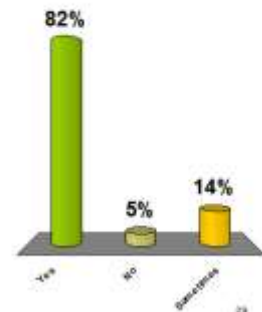
MCQ4 - Did you prefer to have the MCQs at relevant intervals to test knowledge?

- A. Yes
- B. No
- C. Not sure



MCQ4 - Were the 'Clickers' useful in testing the mathematical part of Control understanding?

- A. Yes
- B. No
- C. Sometimes



The use of technology enhanced my learning (e.g. DLE, online reading lists etc)

Option	Qty	Perc.
(5) Strongly Agree	9	39%
(4) Agree	10	43%
(3) Neutral	3	13%
(2) Disagree	0	0%
(1) Strongly Disagree	1	4%
Blank	0	0%
Multi	0	0%



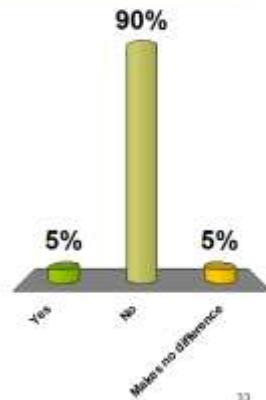
Student feedback

# What do the students think?

Students clearly prefer an interactive method!

MCQ6 - Do you prefer a didactic method of lecturing as opposed to interactive.

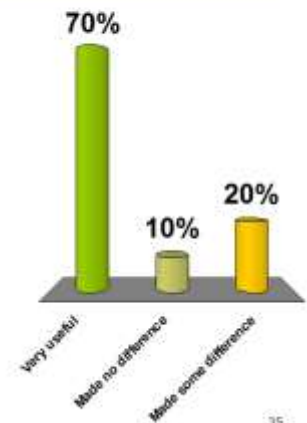
- A. Yes
- B. No
- C. Makes no difference



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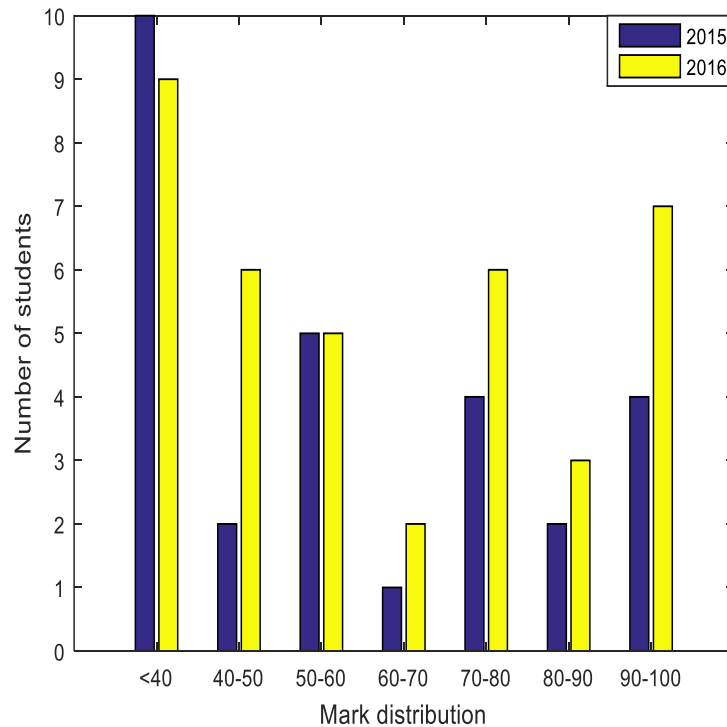
MCQ8 – Overall, how useful was the change in focus from lecture to interactive use of ‘clickers’

- A. Very useful
- B. Made no difference
- C. Made some difference

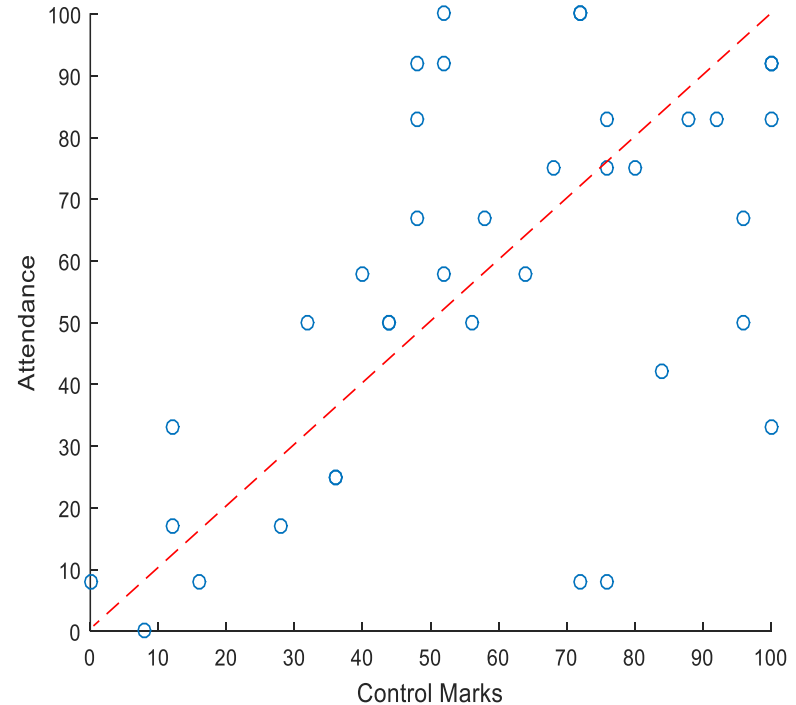


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# Impact on students



Control results improved from 2015

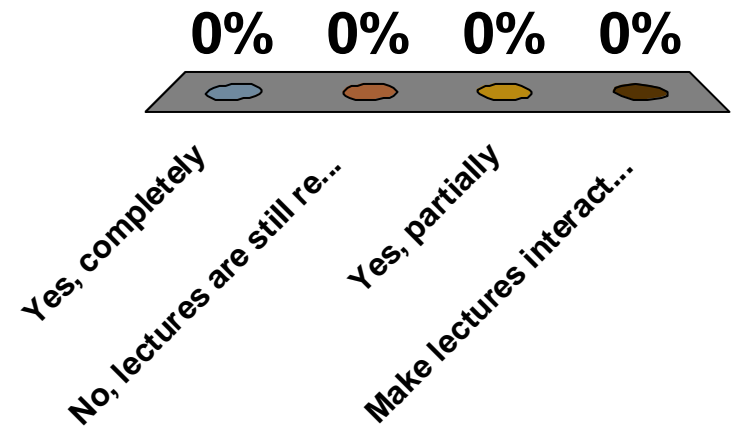


Better attendance = better Control results



# In your view, should we move away from lectures to e.g. flip classroom/PBL, etc.

- A. Yes, completely
- B. No, lectures are still relevant
- C. Yes, partially
- D. Make lectures interactive by introducing some activity

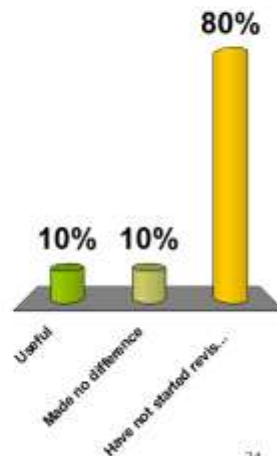


# Impact on Institutional research

## How to make the best use of data

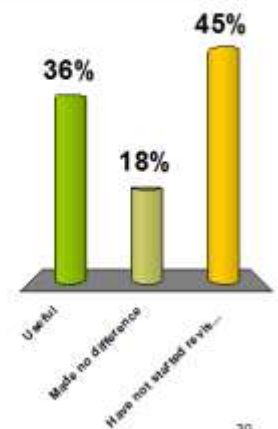
MCQ7 – How useful did you find the MCQs for reflection after the lecture in assisting you with your studies ?

- A. Useful
- B. Made no difference
- C. Have not started revising yet



MCQ5 - How useful did you find the MCQs for reflection after the lecture in assisting you with your studies ?

- A. Useful
- B. Made no difference
- C. Have not started revising yet



Interesting feedback to show that after the lecture majority of the students have not looked at it (half-way point and end of semester)

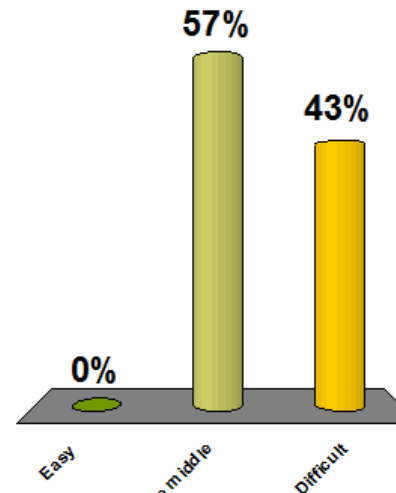
# Impact on Institutional research

## How to make the best use of data

MCQ3 – Relative to other modules how did you find the content of Control

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- A. Easy
- B. In the middle
- C. Difficult



43% of the cohort find Control difficult – how can we use this information to inform the teaching on the module

# Impact on Institutional research – Open issues

Universities will be judged on the quality of teaching - Teaching Excellence Framework

- Interactive lectures
- Move away from lectures e.g. flip classroom/problem-based learning
- Enhance student learning and participation
- Increase student engagement – increase attendance
- Lead to higher attainment

Remember it is the pedagogy that is supported by technology!



Thank you

*Any questions ?*

# References

- <sup>1</sup>Designing effective questions for classroom response system teaching Ian D. Beatty, a William J. Gerace, William J. Leonard, and Robert J. Dufresne Am. J. Phys., Vol. 74, No. 1, January 2006.
- How People Learn; Brain, Mind, Experience, and School (expanded edition), edited by J. Bransford, A. Brown, and R. Cocking (NAS Press, 2000);