# Clicker response timings and their association with grades.

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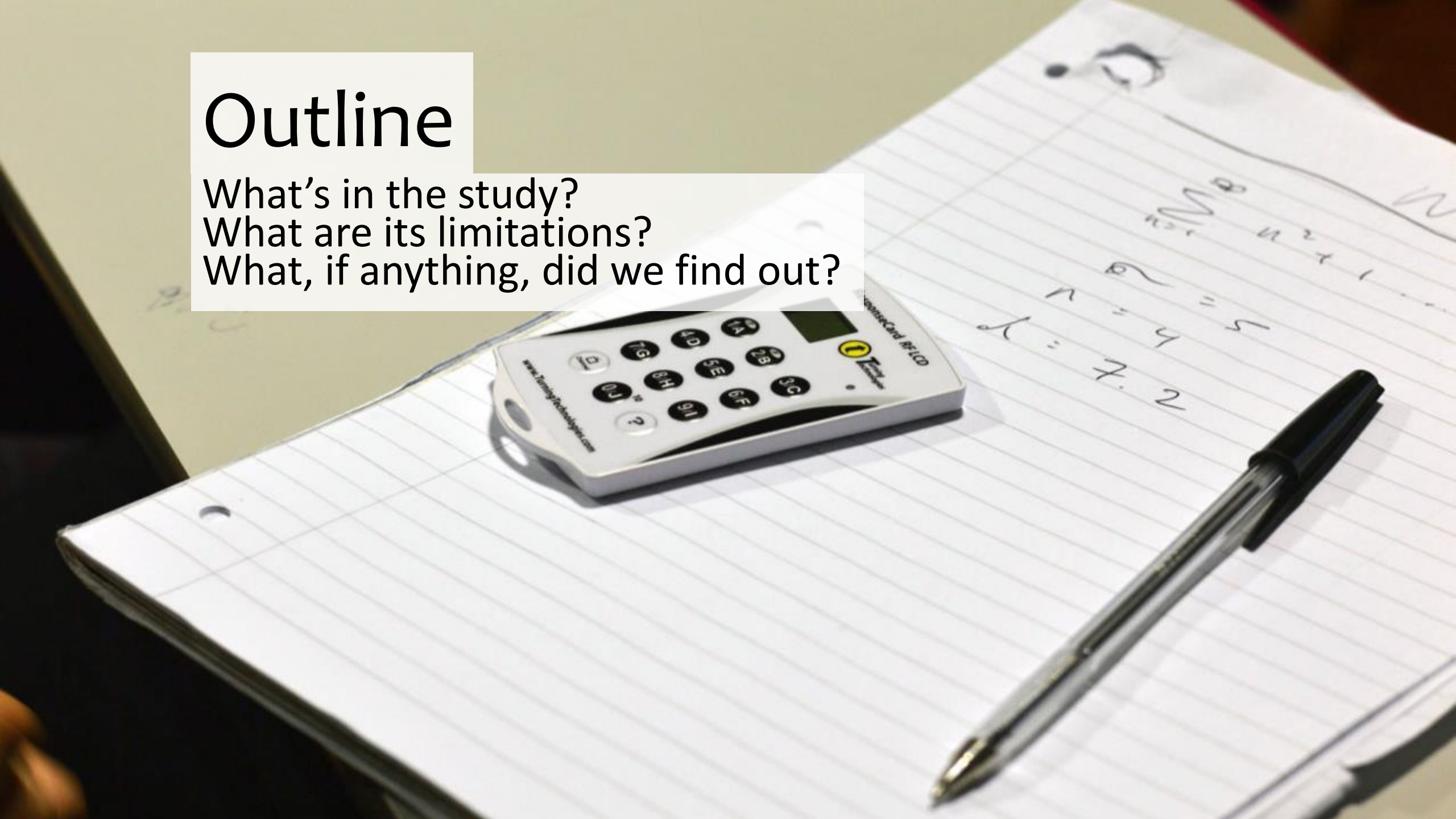
# Outline

What's in the study?
What are its limitations?
What, if anything, did we find out?



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# Project Overview: Clickers

- Early decision to go with *hardware* clickers based on
  - research suggesting students' own devices are a distraction and less effective than a dedicated clicker
  - and anecdotal suggestion that it lowers the barrier to entry for busy/reluctant staff (this is a *staff engagement* project as well as being student-focused)
- This decision was eventually backed-up by our own evaluation:
  - Student survey: 50:50 divided between "happy to use own device" and "would prefer a clicker"
  - Staff focus group: "phones would be a distraction"
  - Student focus group – divided: some wanted a hybrid hardware and software option, some were (like staff) in favour of hardware only for similar reasons

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# Our staff views on clickers

- The staff would prefer for the students to use clickers and not their mobile phones.
  - mobile phones can distract the students
  - students may not have a mobile phone or may not be able to install the relevant app on their phone and students may not have reliable access to Wi-Fi.

*"The University should provide Clickers or whatever technology they choose, the student shouldn't worry about it."*

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# Student and Staff views

- 2015: in-class survey of 216 first year students
  - Over 96% of responding students found the clicker easy to use.
  - 44% of the Mathematics students chose “Yes, to make learning more active.”
  - When asked if they felt that the quizzes have been beneficial to the learning, only 15 (7%) students somewhat/disagreed

*“I like Clickers because they give immediate feedback”*

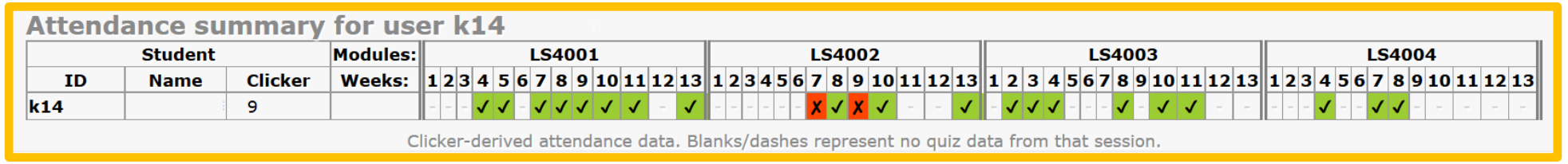
- 2015: staff focus group
  - the majority of staff said that using clickers in their teaching increased participation, reflection, feedback and peer discussion

*‘Comparing to when we don’t use clickers, students will not necessarily put their hand up in case they get something wrong.’*

*‘The Clickers are a platform for quiet students.’*

# Web site: Data views for students

- Might showing students a record of their “engagement” influence their behaviour?
- Simple “widget” embedded into the VLE



Attendance summary for user k14

| Student | | | Modules: | LS4001 | | | | | | | | | | | | | LS4002 | | | | | | | | | | | | | LS4003 | | | | | | | | | | | | | LS4004 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ID | Name | Clicker | Weeks: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| k14 | | 9 | | - | - | - | ✓ | ✓ | - | ✓ | ✓ | ✓ | ✓ | ✓ | - | ✓ | - | - | - | - | - | ✗ | ✓ | ✗ | ✓ | - | - | ✓ | - | - | ✓ | ✓ | ✓ | - | - | ✓ | - | ✓ | ✓ | - | - | - | - | - | - | - | ✓ | - | - | ✓ | ✓ | - | - | - | - | - |

Clicker-derived attendance data. Blanks/dashes represent no quiz data from that session.

- Student focus group answers: Predominantly *No!*

*“Attendance monitoring will make no difference, motivation will make a difference … I know what I missed and I don’t need to look at my attendance”*
(Majority representative view.)

*“Having a lot of red crosses made me attend a particular module; it has motivated me to attend”*
(Just one student!)

# If not attendance, then what?

**Clickers Project: Latest quiz scores for ANON STUDENT (k0000000) from MA5200**

You attempted the most recent quiz on 19/10/15 where you scored 5/5:

Question: If a sequence is strictly monotonic increasing
Your answer: each term is smaller than the next ✓
You scored: 1/1

Question: Which two of the following together mean a sequence of real numbers converges?
Your answers:
The sequence is monotonic increasing ✓
The sequence is bounded above ✓
You scored: 4/4

**Details for MA5200>**
**Your Clickers Modules**
**Your Engagement Profile**

› So the students can see their responses, can they give us useful information about their in-class engagement?

# Hypothesis

***Monitoring students' weekly online and CRS data in a Flipped Learning environment can help to identify those who are disengaged and at risk of failing.***

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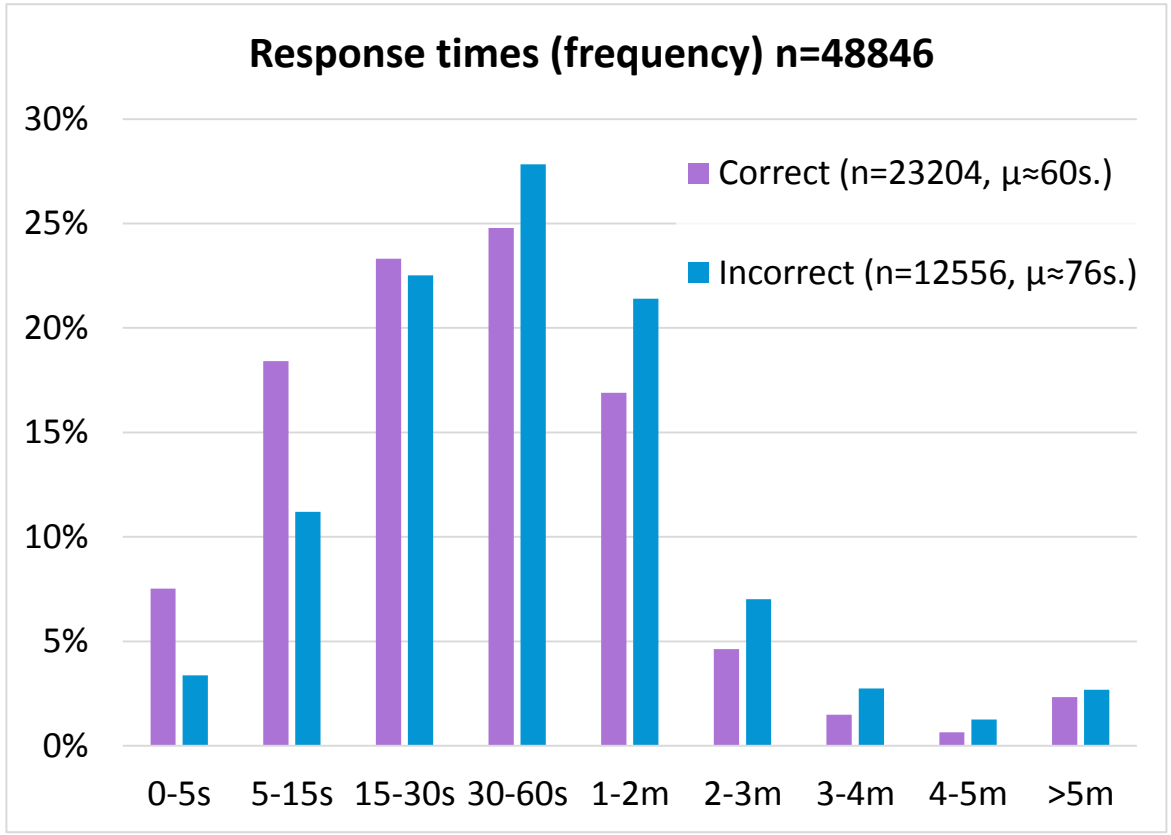
# What are response times typically?

- This is *everything* from our "clickers" database in 2015/6, all the messy data gathered from
  - 7 subject areas
  - 28 distinct members of staff
  - 30 different modules
  - 268 teaching sessions
- Overall, correct responses are faster ($p<0.01$) which agrees with one recent study but it may be case-specific…
- Needless to say we'll focus on one module and just a few classes :-)



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# Retrospective analyses…

- Context:
  - 5 weeks of “flipped” mathematics (linear algebra)
    - Online e-assessments (“Numbas” quizzes) before each class
    - Peer Instruction using clickers questions in class
    - Summative assessment a few weeks after the classes end
- Can we identify “at risk” students from their clickers usage pattern?
  - They’re “at risk” in this context if they fail the summative assessment.
  - Are clickers or quiz results correlated with this?
- Previous research:
  - Prof Eric Mazur (Harvard) in Miller *et al.* (2014) with “Peer Instruction”
    - response times for correct answers are significantly faster than for incorrect answers,
    - in contrast to Heckler *et al*. (2010) with the converse result

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# Data cleaning & preparation

- TEL researchers working with “live” modules and “real” (*aka* undisciplined?) academics :-# means datasets seldom “clean”
  - Out of roughly 50 “clicker” questions only 20 were usable
- Students classified as
  - P = “Prepared” if they did the quiz before class (otherwise “U”)
  - C = “Correct” if “clicker” responses were largely correct (otherwise “N”)
  - Students’ responses categorised 4 ways
    - PC = Prepared and generally Correct
    - PN = Prepared but Not generally Correct
    - UC = Unprepared but generally Correct
    - UN = Unprepared and Not generally correct

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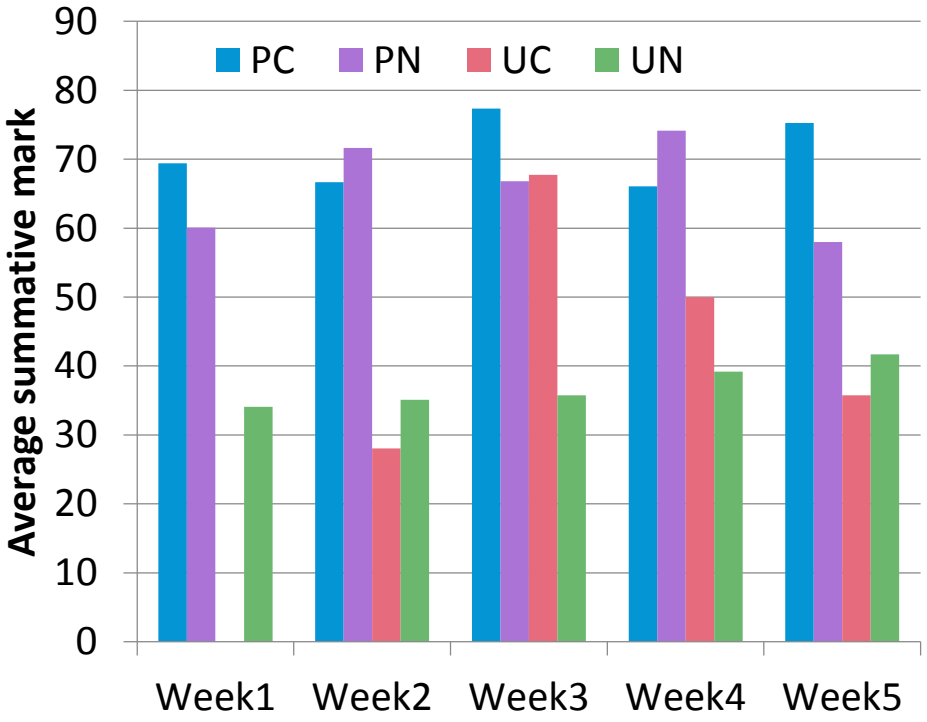
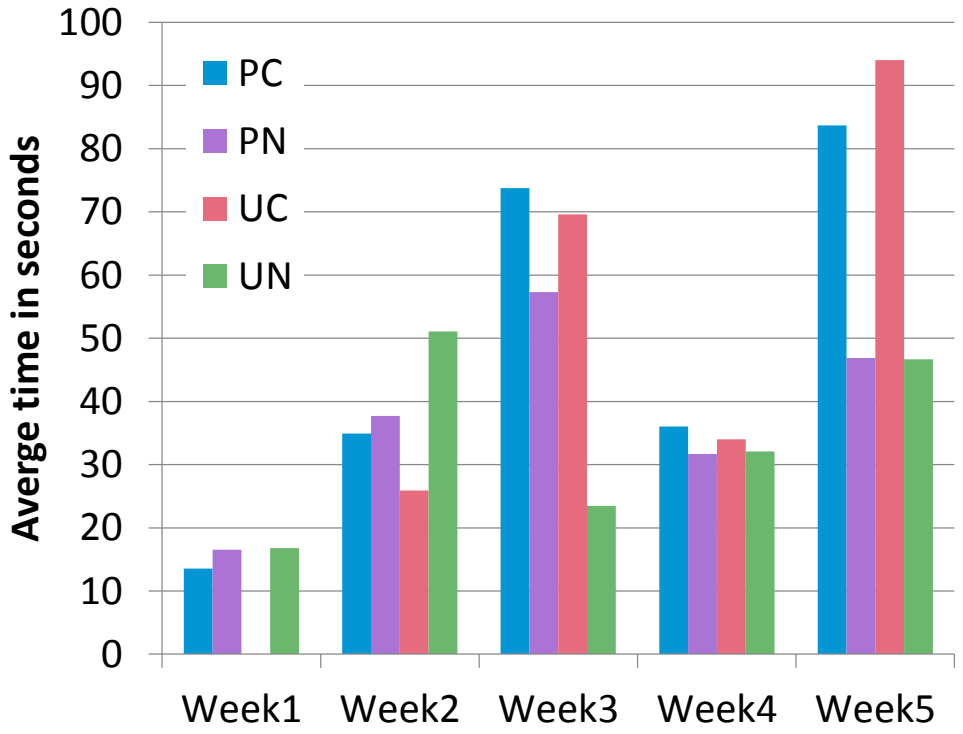
# Weekly data conclusions

## PREPAREDNESS TRUMPS CRS




## CORRECT CRS RESPONSES ARE SLOWER



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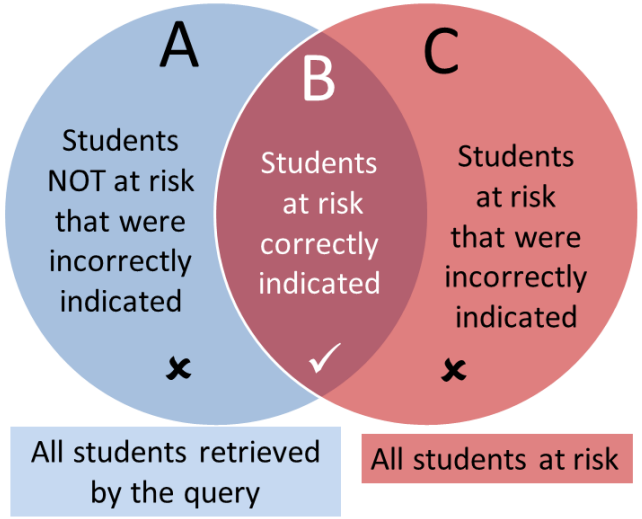
# Can monitoring students' weekly online and CRS data in a Flipped Learning environment help to identify those who are at risk of failing?

- Absence of preparation could be a factor in a risk indicator.
  - Varies week-by-week (question difficulty and/or direct link to summative assessment) but *e.g.* the mean mark for students who were prepared in Week 4 is significantly higher than for unprepared students ($p<0.01$; $n=69$).
- Responding incorrectly is not a risk indicator.
  - No statistically significant difference was found in the mean summative marks between students who responded correctly in-class *versus* those who didn't.
- Responding correctly takes longer.
  - The difference in mean response time for correct responses was 73.7s as opposed to incorrect responses with a mean time of 69.5s, which was not quite statistically significant ($p=0.074$; **n=60**) but interesting nonetheless.

# Is prediction possible from a really simple indicator?

- Unprepared students may be at risk of eventual failure – is such a naïve measure useful?
  - This is a relatively small study (n=80) but of the 6 “at risk” students (defined as taking the summative assessments but scoring less than 40% overall), 4 were unprepared and 2 were prepared.
  - To take this further more data are needed where students’ “preparedness” can be measured and compared to their final results.
    - (Flipped Learning is a useful testbed here.)



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# Conclusions

- Clickers work ☺ Students *and* staff like them and find them easy enough to use.
- Flipped Learning and Peer Instruction environments with clickers can provide interesting/useful data
  - *E.g.* for "learning analytics" approaches
- Whether or not response times are correlated with
  - in-class correctness (maybe)
  - eventual summative progression (probably not)

it's clear that even "medium-sized" cohorts (n=80) are too small at this stage to draw statistically-significant conclusions … more data/more participating institutions are needed

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# Thanks for your interest ☺

- Any questions?
- Anyone interested in clickers and working together?
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  - http://sec.kingston.ac.uk