NUMBAS for Chemistry – Adaptive Marking in Chemistry Practicals

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28/04/2022

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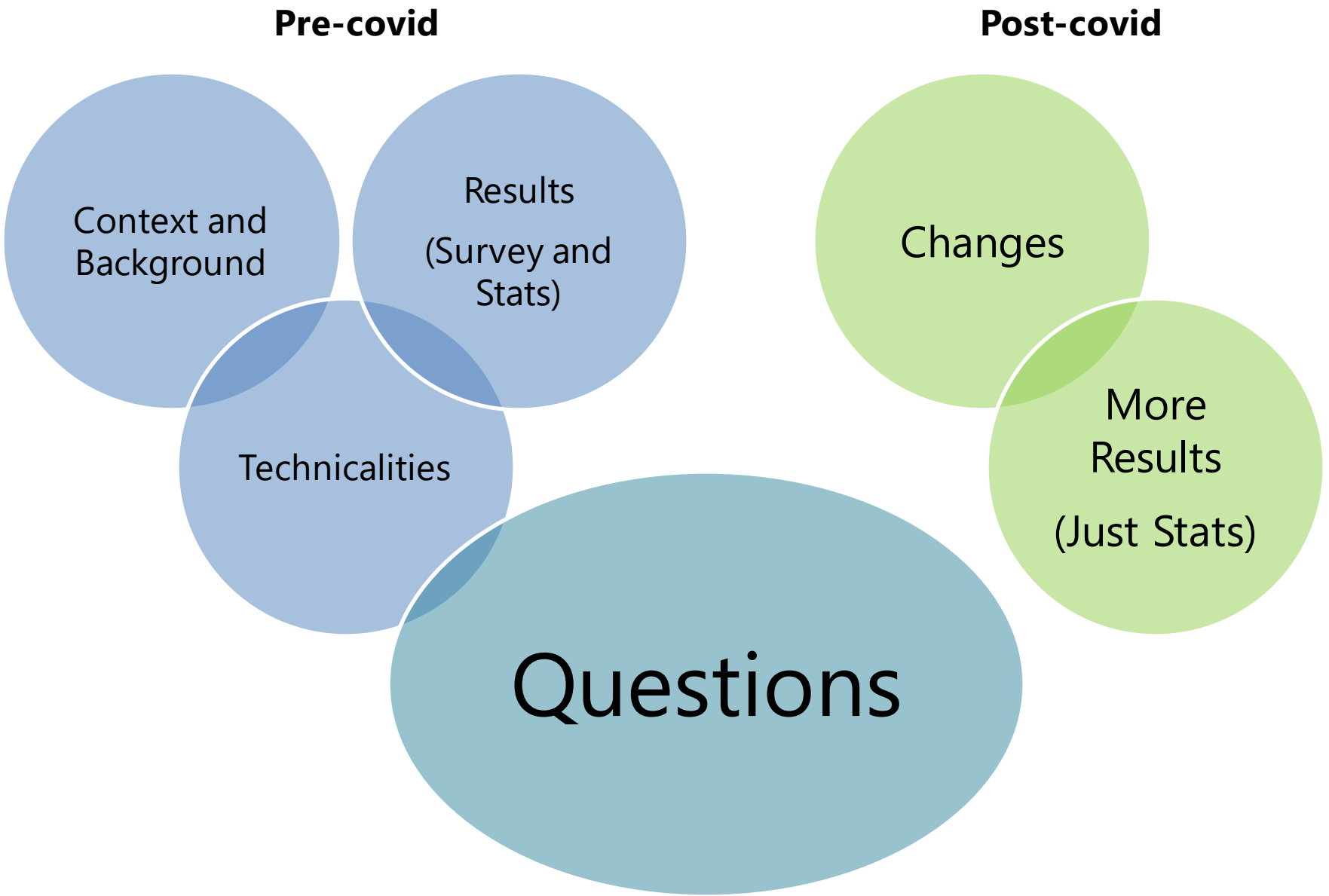
Overview


Pre-covid
Post-covid
Context and Background
Results
(Survey and Stats)
Technicalities
Changes
More Results
(Just Stats)
Questions

Introduction

- Student's might expect:

- In context:

(b) i) $\nu = \frac{1}{2\pi}\sqrt{\frac{k}{\mu}}$ so $(2\pi\nu)^2\mu = k$

$(2\pi \times 6.424\times10^{13})^2 \times 1.138\times10^{-26} = 1854$ $N\,m^{-1}$

s^{-1} kg

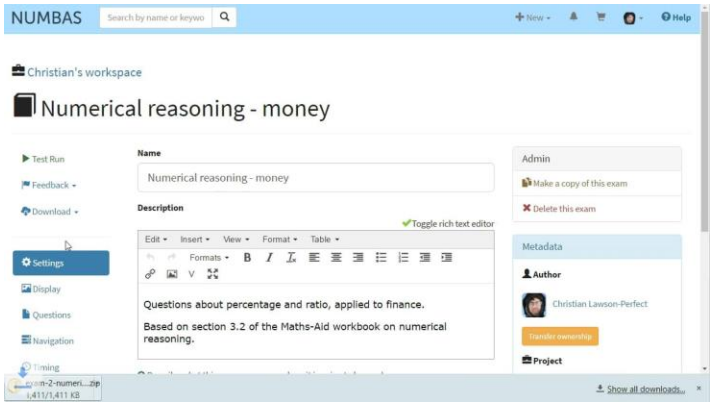
[As an aside, because force = mass × acceleration $F = ma$ then $1\,N = 1\,kg \times 1\,m\,s^{-2}$ which accounts for the units used in the equation above]

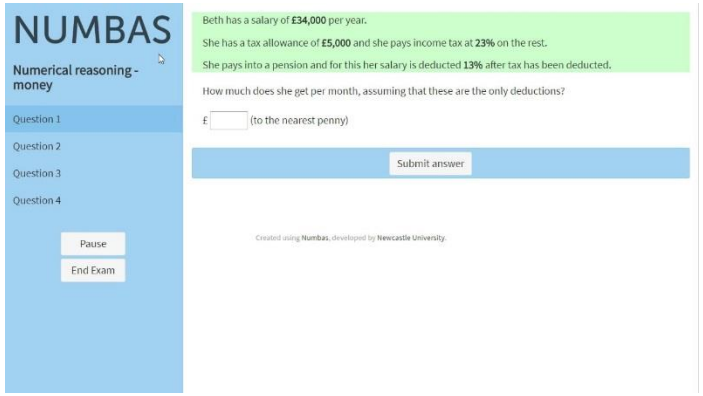
- … and many employers like it

Objectives

- Enhance chemistry students' numeric skills
- Boost students' confidence tackling challenging mathematical problems
- Generate practice questions and feedback that support learning cycles

- Develop skills in using NUMBAS to deal with all of the above



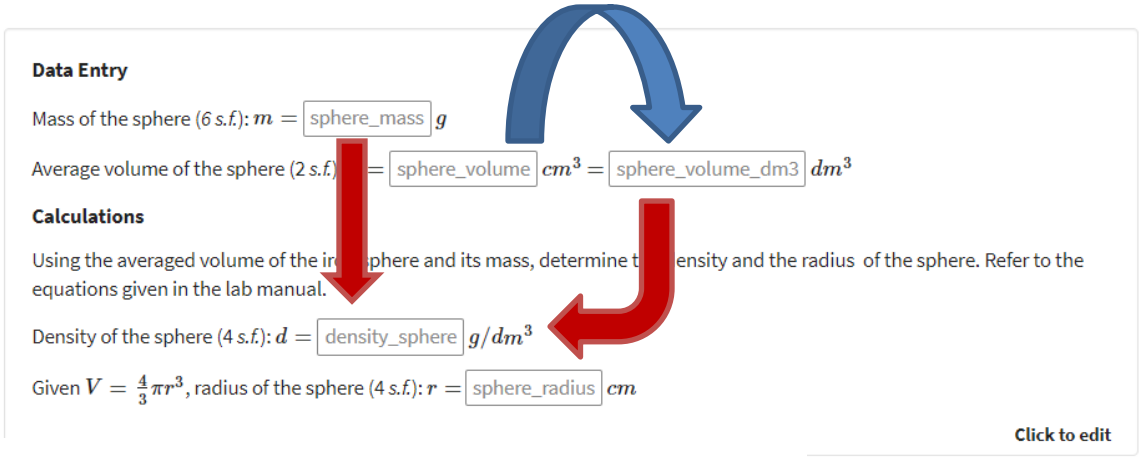


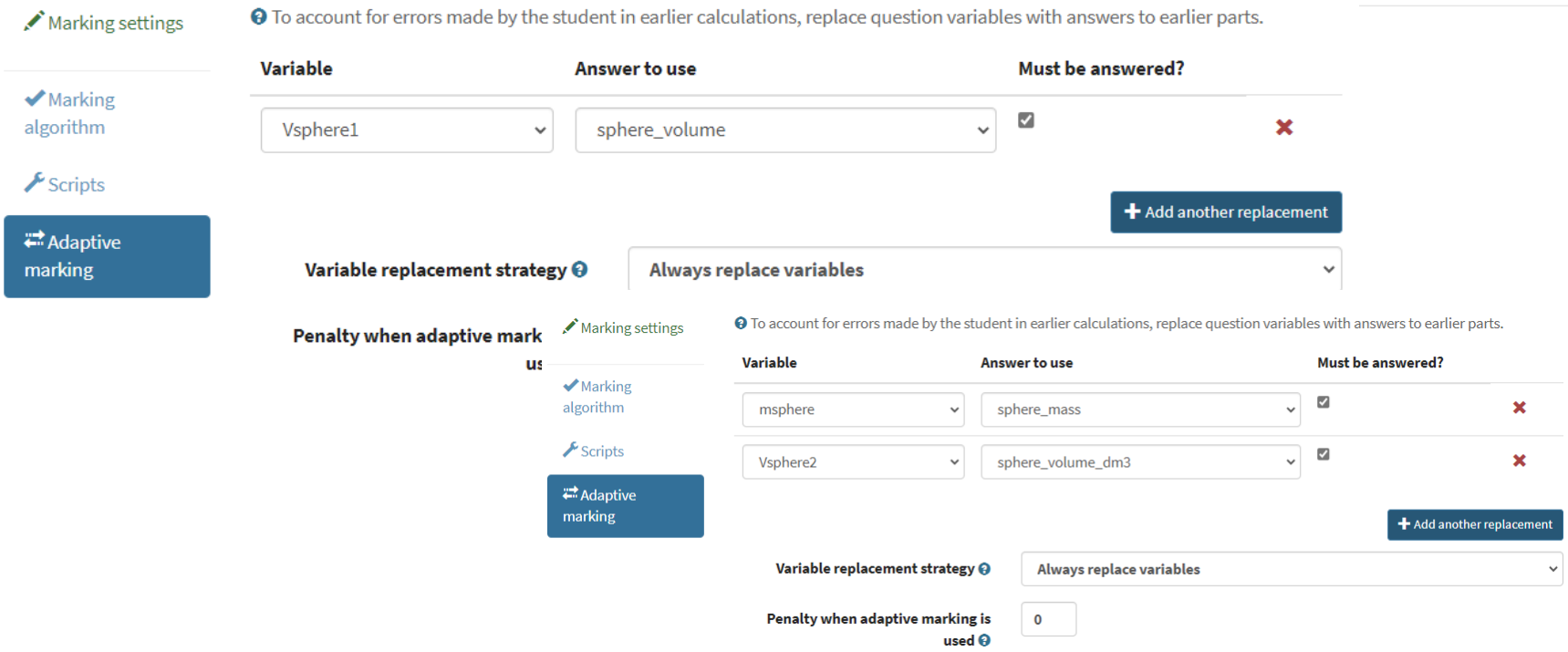
Methods

- **Number entry** and conventional questions (MCQ/Gapfill)
  - *Good interface and functionality (partial credit, visibility)*
- Improving **feedback**
  - *Quick Turnaround, <1 week, quick feedback*
  - **"Fair"** marking – no errors, consistency (vs. multiple markers)
  - *Data as variables – mistakes become calculation errors*
  - *Feedback tailored to focus on needs*

Adaptive Marking

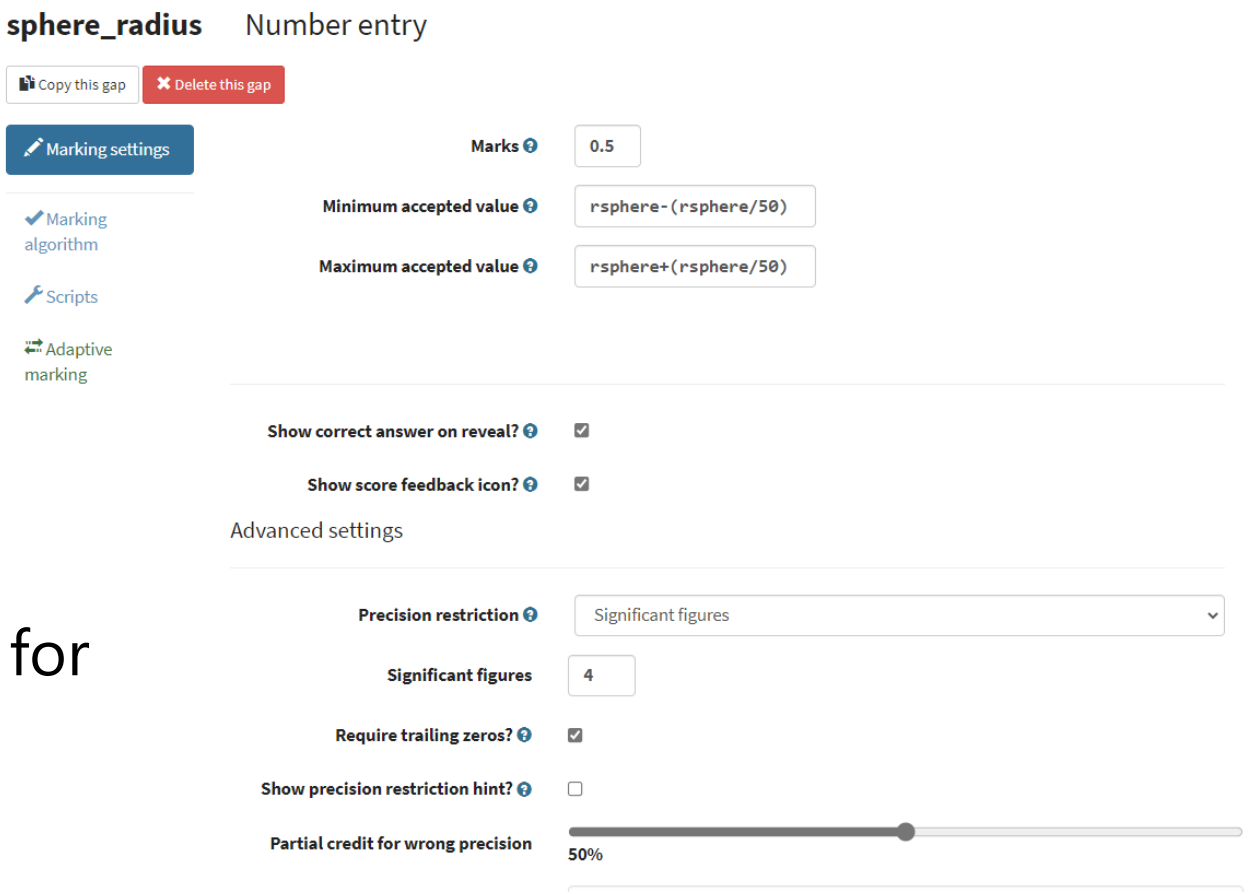
- Adaptive marking





Precision

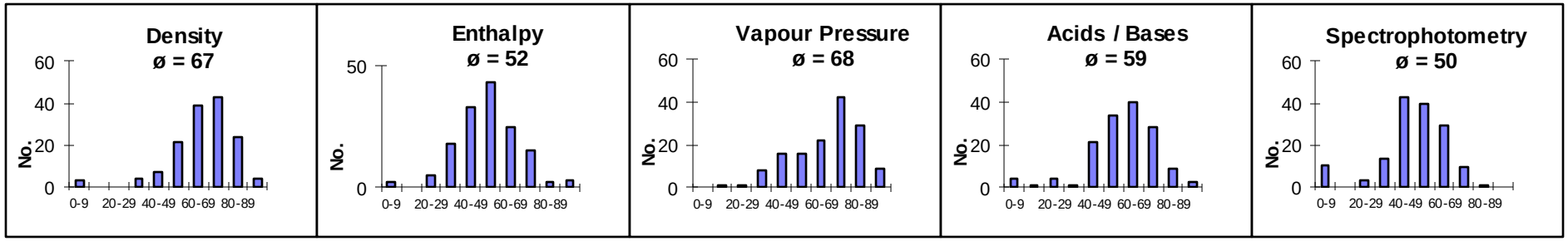
- ±2% - rounding
- 50% mark penalty for s.f.



Initial Statistics (2018 and 2019)

- Comparatively low N/A rates (~3%)
- Considerable fail rates by experiment (up to 15%)
  - ~5% lab component fail
- Discrimination of marks
- Individual question evaluation

2018



2019 ø = 73 ø = 61 ø = 71 ø = 66 ø = 58

Pilot Survey 2018

- Quantitative: n ~ 60, Qualitative: n ~ 35
  - Relatively clear connection between learning activity and assessment
  - More guidance when completing assessment – use formatively?
  - Learning most from **using** equations
  - Students didn't trust the algorithm

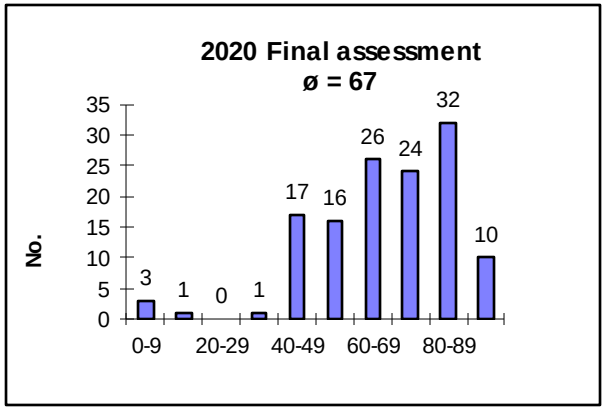
Evolution

- **Pre-covid**
  - **2018-19:** Introduction, 5 summative tests - 20% of 20c module = total 4c
    - Graph submission (20%), Notebook record (10%) and NUMBAS score (70%)
  - **2019-20:** correct mistakes, generate new ones (adaptive marking)

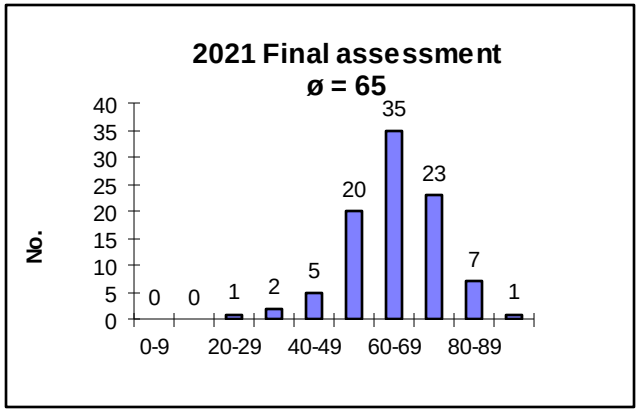
- **Covid-affected**
  - 2020-21: No laboratory work, videos and LabSims (LS) – switch to **random**
    - P/F tests with randomised variables as data to ensure continuous engagement (part of "skills record")
    - Final summative test using randomised variables for data
  - 2021-22: mix and match
    - 2019 resources with **adaptive** marking
    - 2020 **randomised** data summative assessment (20% of 20c module)
    - [2020 P/F resources for non-attendees (PEC)]

Statistics: Summative assessment (2020 and 2021)

- 2020 (no labs, all online)
  - Late submissions: 8.4%
  - No submission: 2.3%
  - Fail: 1.5%



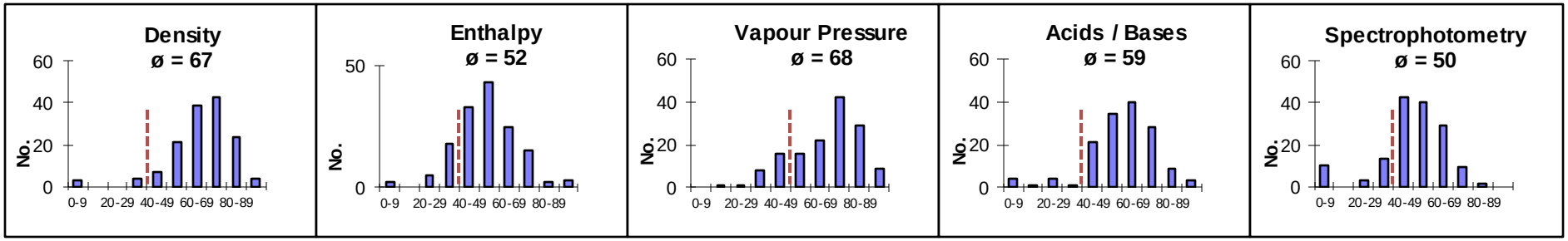
- 2021 (labs in person)
  - No late submission
  - No submission: 5.1%
  - Fail: 3.1%



Statistics: Experiments (2020 and 2021)

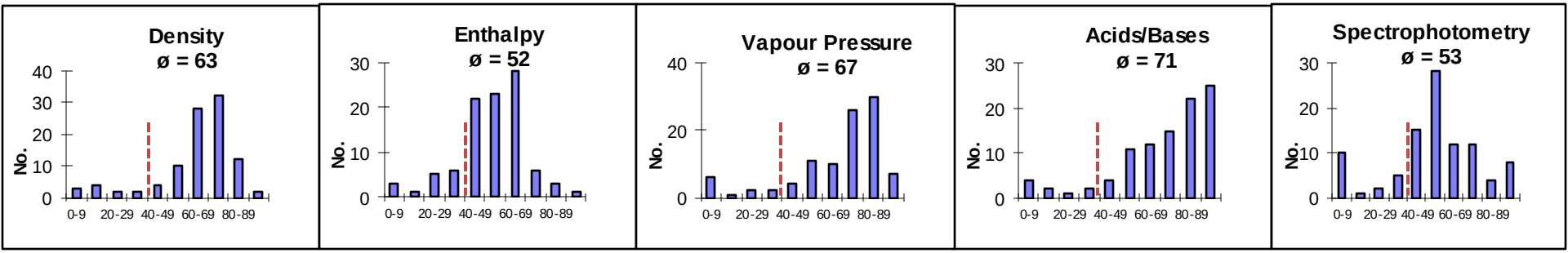
- Previous data

2018



2019 ø = 73 ø = 61 ø = 71 ø = 66 ø = 58

- 2021 (shorter, some challenging questions removed)



Questions