



UNIVERSITY OF
BIRMINGHAM

An Online Degree in Engineering

Contradiction or a **Living** Reality?

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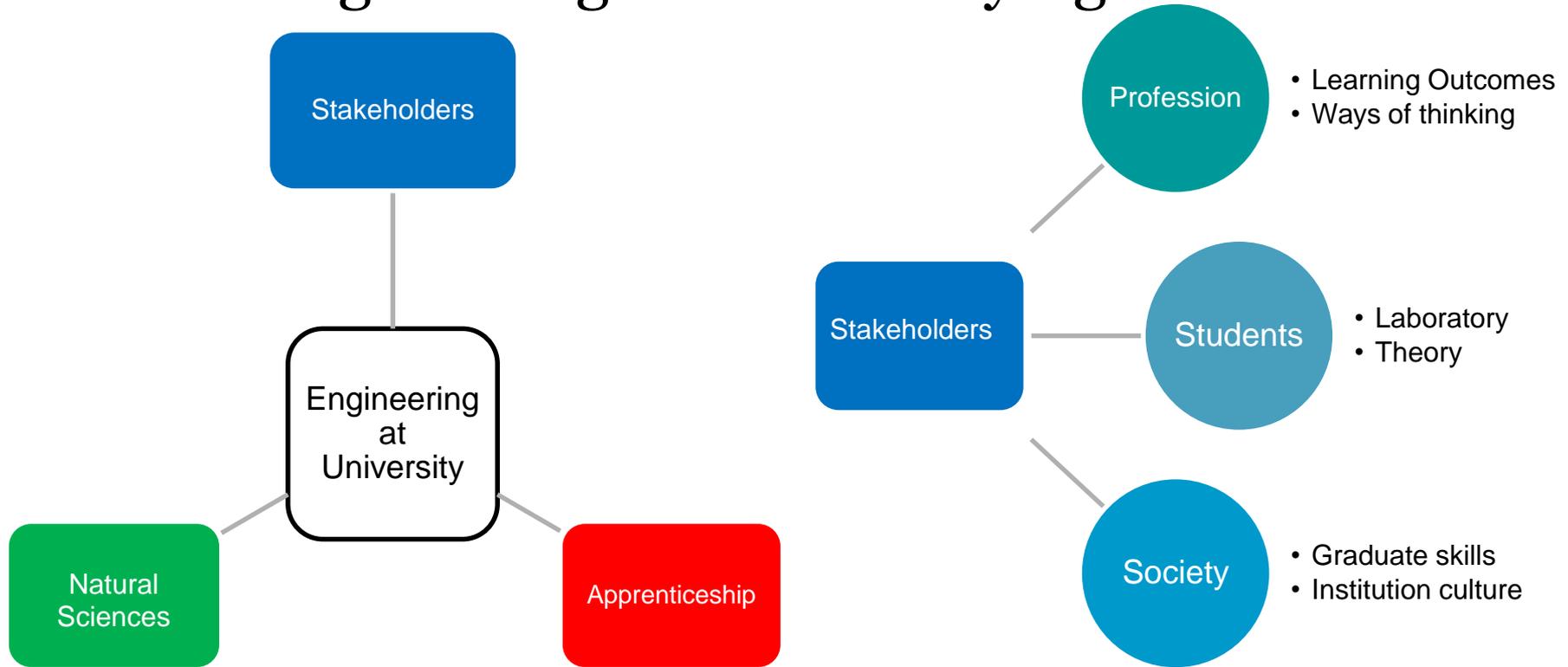
ASIIN-FIGURE-EASPA GLOBAL CONFERENCE 2021

Structure of this presentation

- **Claim:**
In-person hands-on learning is essential for an engineering degree
- **Caveats requiring adjustments to stakeholder expectations:**
Societal conditions
Scale
- **Evidence:**
Scholarship
Observation



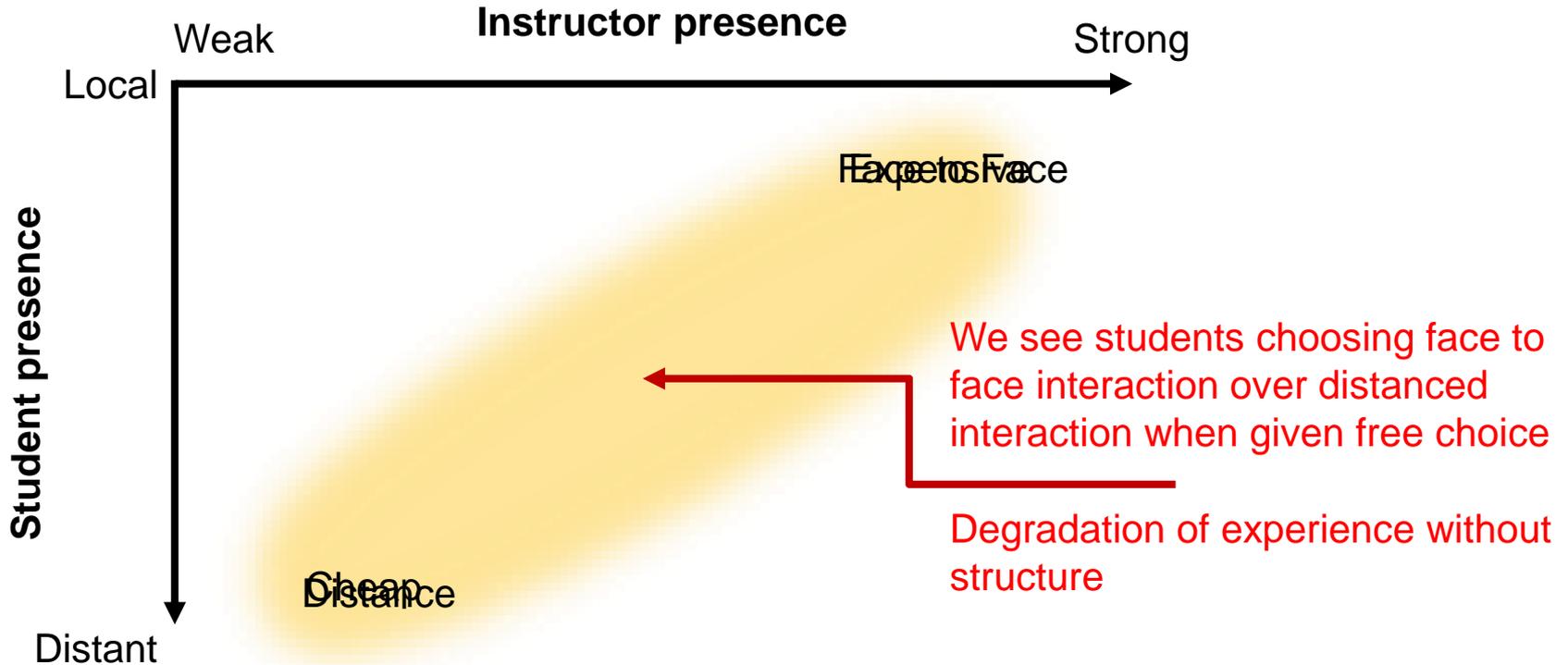
What is Engineering Education trying to achieve?



Institutional pressure for in-person teaching



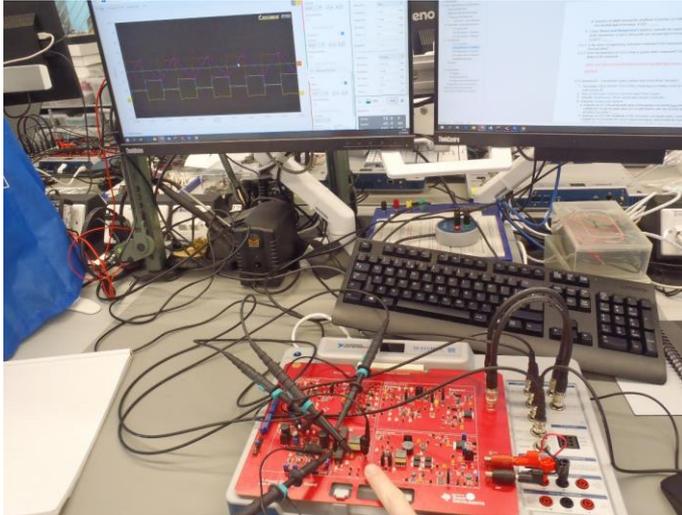
Student experience





What is laboratory education trying to achieve?

- Understanding of the physical world

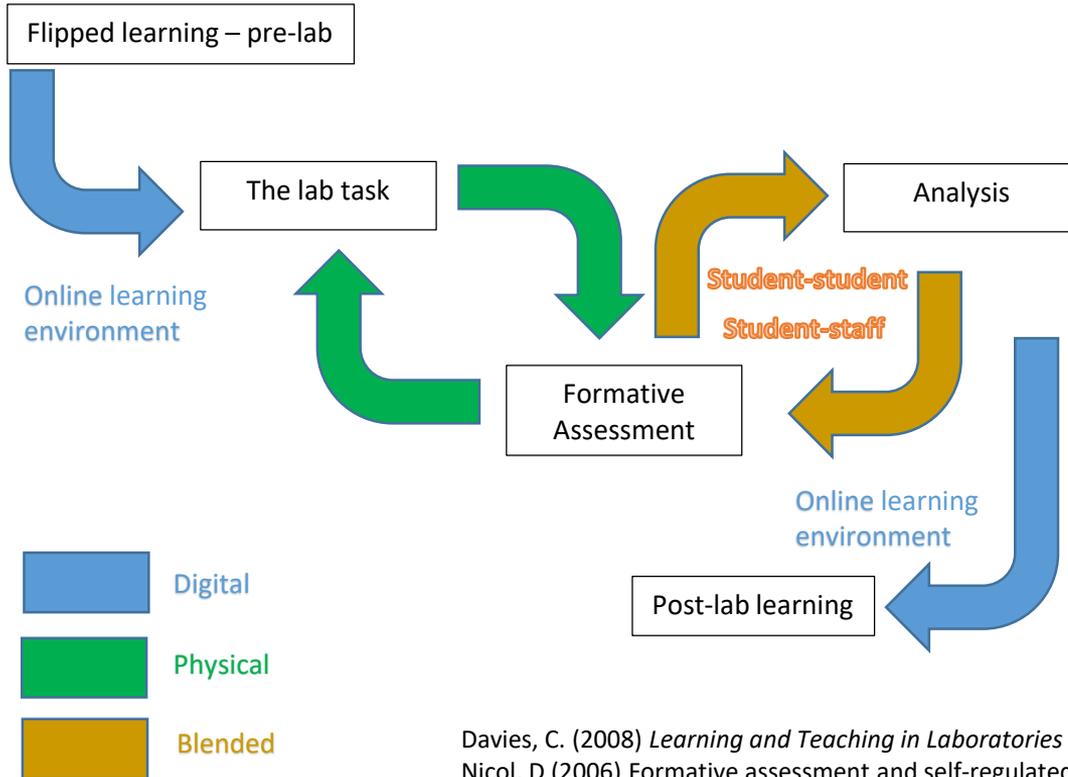


- Presence and engagement
- Physical manipulation
- Unfamiliar and unexpected
- Realistic Skills Assessment

- Variation of experience
- High cognitive load
- Immersion



Learning around the laboratory



- Professionalism
- Interact technical staff
- Collaborate methods
- Collaborate analysis
- Decide collectively
- Internalise
- Build identity
- Gain “good feedback”

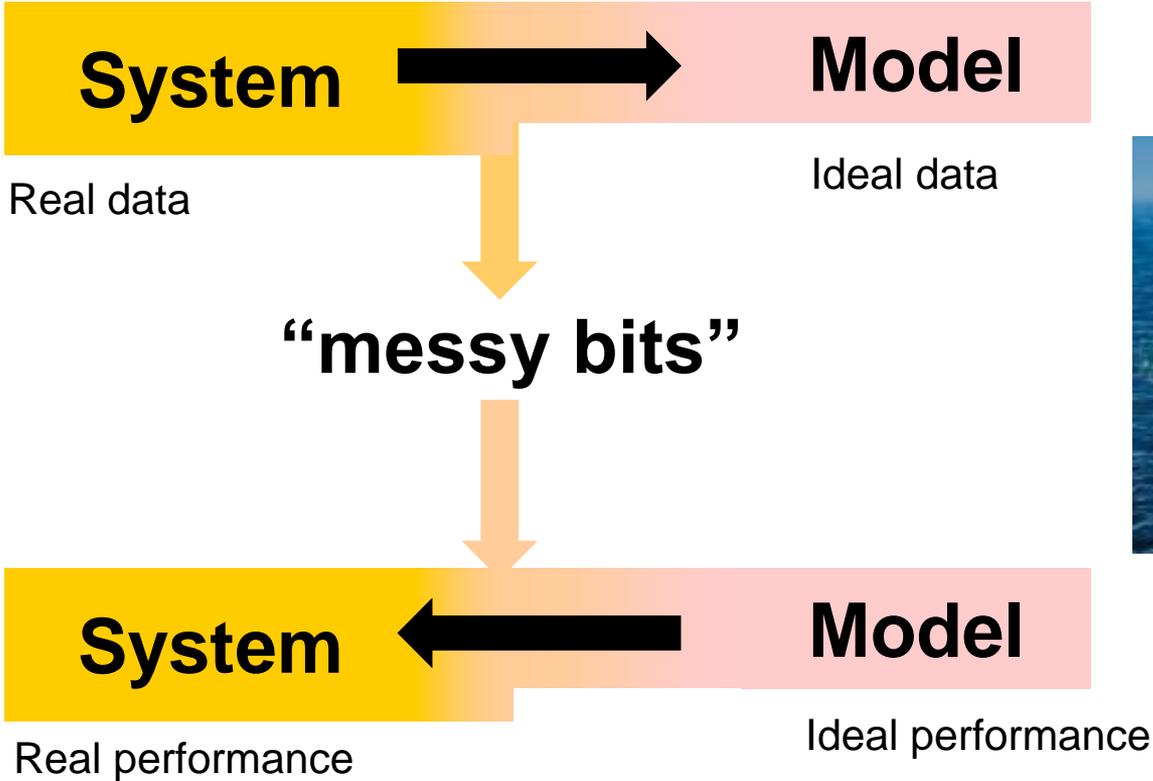
Davies, C. (2008) *Learning and Teaching in Laboratories*

Nicol, D (2006) Formative assessment and self-regulated learning: a model and seven principles of good feedback practice

Hanson, B (2009) ReLOAD: Real Laboratories Operated at a Distance

Cranston, G. (2015) Techniques to encourage interactive student learning in a laboratory setting

Abstraction loses data



Responsibility to intervene



Digital doesn't solve all challenges to inclusivity..

- Access (digital poverty)
- Accessibility
- Roles assumed by learners
- Ability to intervene

..particularly in asynchronous collaboration

Digital labs – partial success?

- Virtual labs “....share many of the attributes....”
- Mixed reality as a compromise
 - Social, cognitive and emotional presence
 - Interaction between people and avatars
- Challenges
 - Hardware
 - Bandwidth and connectivity
 - Synchronicity across time-zones
 - Cultural awareness
 - Emotional awareness
 - Trust and confidence
 - Degradation of experience
 - Evaluation of experience



Potkonjak 2016 Virtual Laboratories for education in science, technology and engineering: A review
Bhute 2021 Transforming traditional teaching laboratories for effective remote delivery—A review
Gunasekara 2021 Remote Laboratories in a Digital Age
Callaghan 2008 A Mixed Reality Teaching and Learning Environment
Carpenter 2020 On students (mis)judgements of learning and teaching

Conclusion: The Experience of Learning

The affordances of the campus education

- Presence and immersion
- Breadth and depth
- Engineering as a social activity with responsibilities
- Transformation between thought and practice
- Preparation for the unfamiliar
- Thinking/acting as a professional engineer

**More easily achieved in
depth in the physical lab**