Faculty of Science

Animal Welfare Science Centre

Digital innovations to replace, reduce and refine animal use in education

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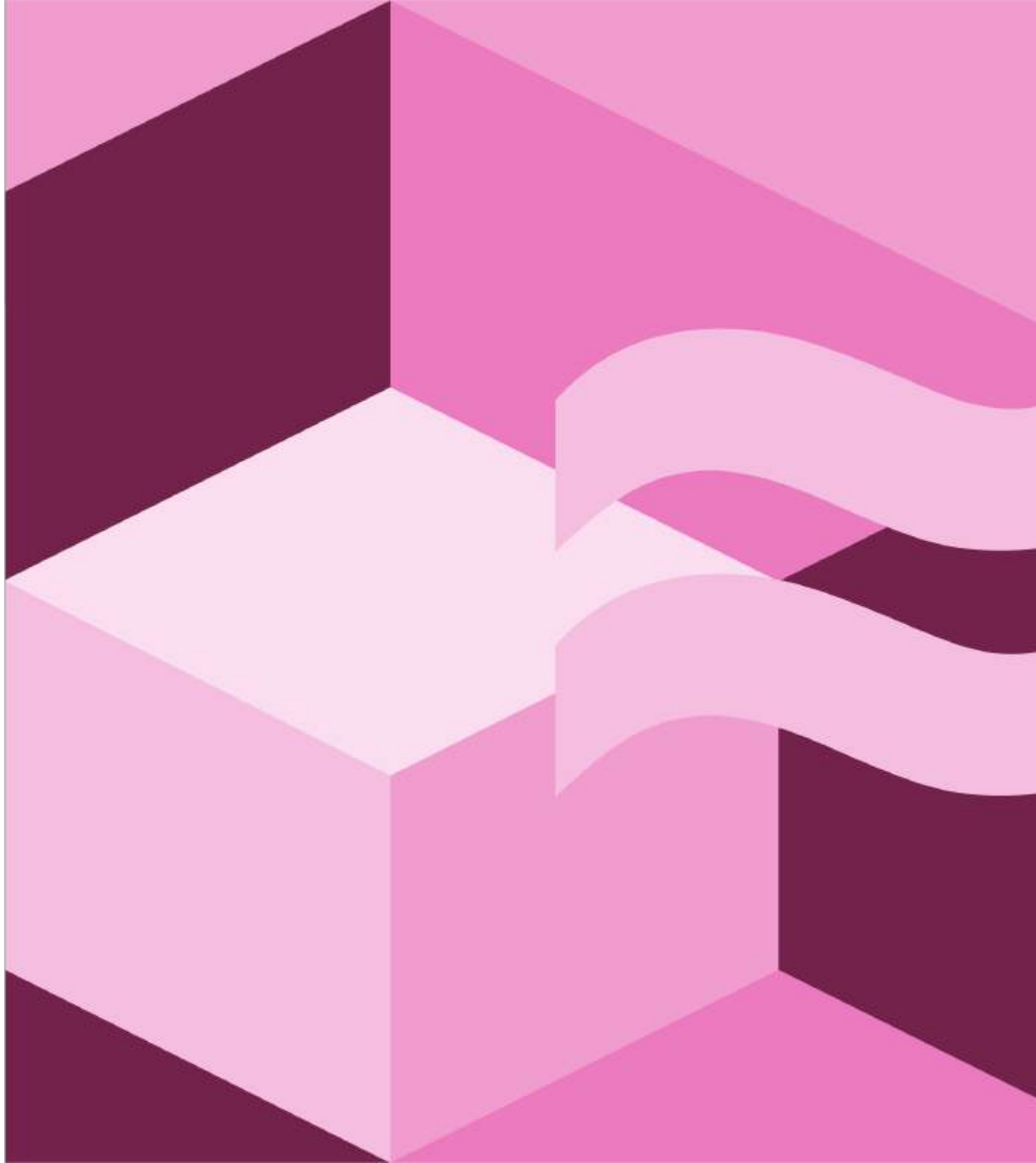
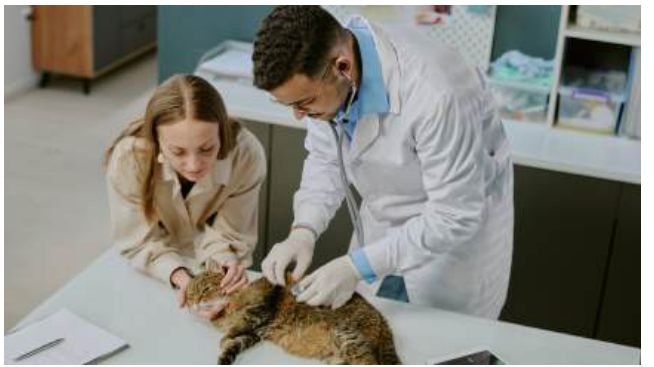


Animal use in education

Animal use in education





Spectrum of animal use

Necessary for learning

Useful for learning

Enhance the student experience

Impact on the animals

An ethical requirement… but rarely reported in the literature!

Students' views

In veterinary degrees:

- Students' motivation is higher when studying subjects involving animal interaction [1]
- When there are a lack of opportunities to work with animals, students feel underprepared and incompetent [2]
- Students value opportunities to interact with the same animals to build a bond, and positive interactions with animals [3]

[1] Parkinson et al. (2006) JVME 33(2), 253-265

[2] Gronqvist et al. (2016) Animals 6(11)

[3] Khoddami et al (2025) JVME e2024013

Students' views

However…

Veterinary students feel ethically conflicted about animal use in their education, and this negatively affects student wellbeing

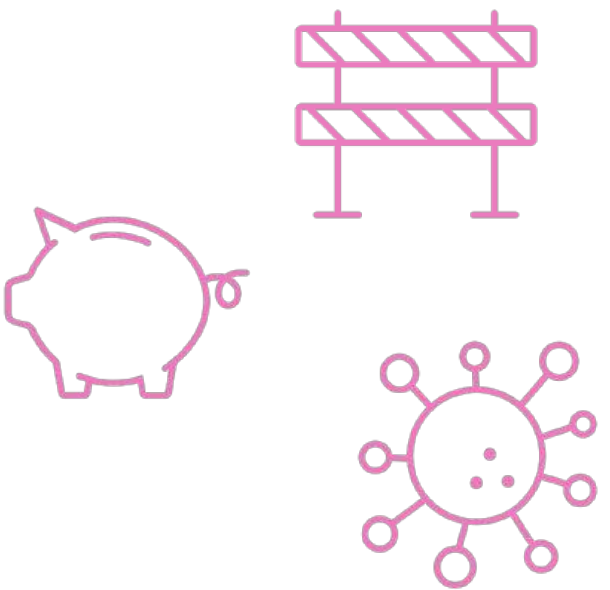
Unsurprisingly, student wellbeing and animal welfare appear connected

Khoddami et al. (2025) JVME e2024013

Other problems with animal use in education

Economic and logistical barriers

- Increasing student numbers
- Decreasing staff numbers
- Financial cuts in higher education
- Negative media attention
- Higher farm biosecurity concerns



Opportunities to replace, reduce & refine animal use in education are clearly needed

Alternatives to live animal use

- Physical animal models, videos and photos are effective for teaching anatomy, dissections etc [1]
- But, still limited in what they can be used for

[1] Patronek et al. (2006) JVME 33(2), 253-265

Digital innovations to improve animal welfare in education

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Animal welfare education

Animal welfare should be a core component of agriculture, animal science and veterinary degrees

Challenge:

Providing students with effective opportunities to apply, analyse and evaluate their knowledge of welfare indicators, and understand real-world complexities

Virtual pigs

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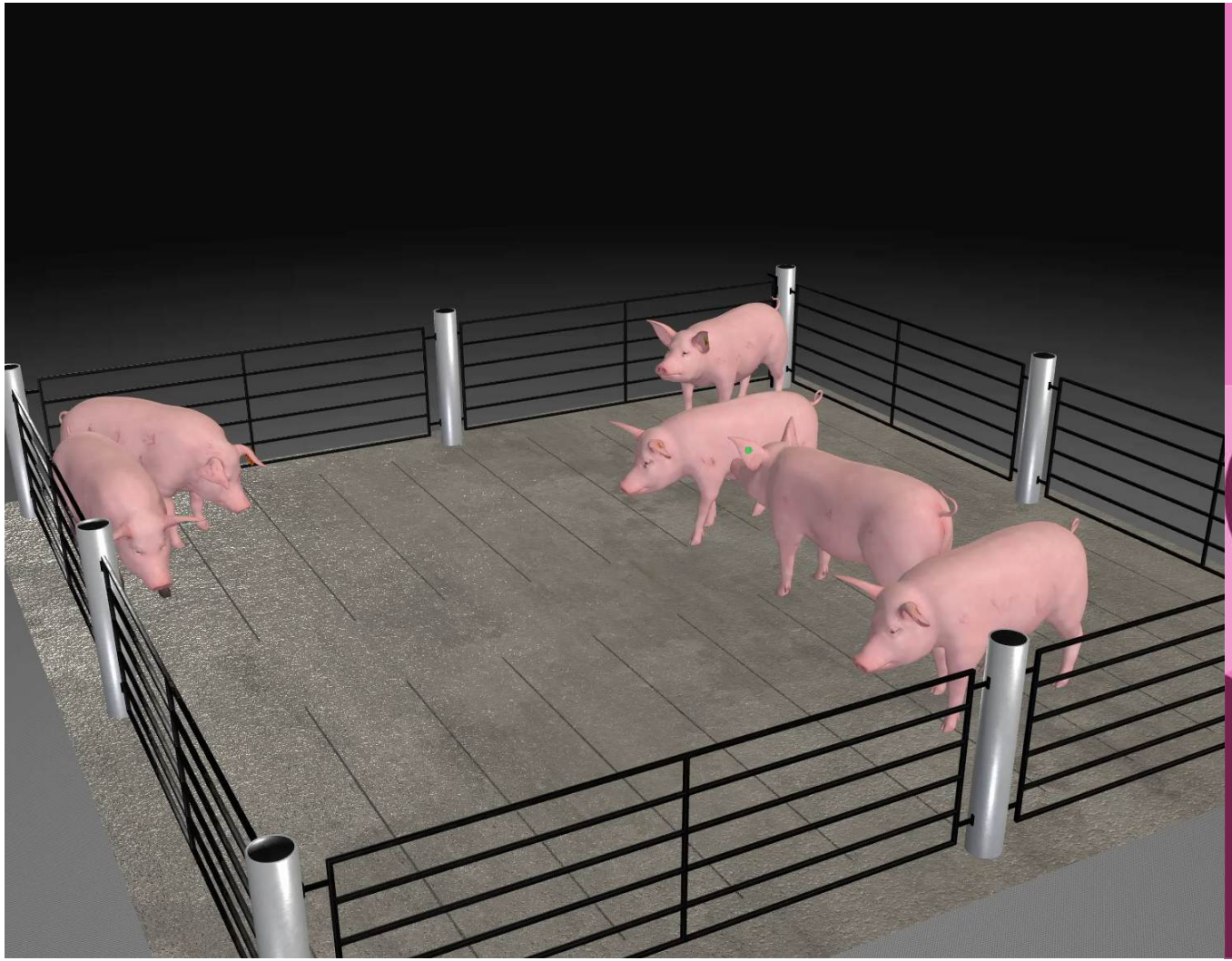
Virtual pigs



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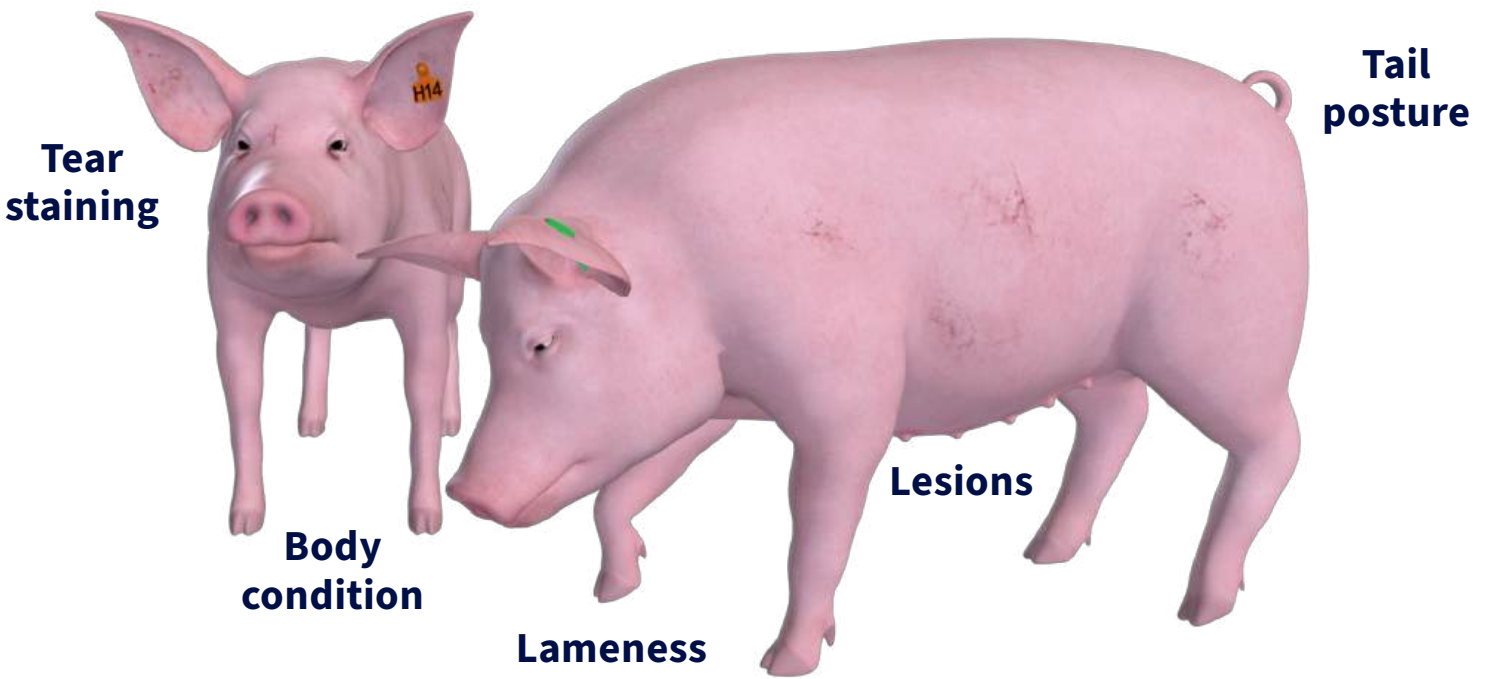
Virtual herd of 15 pigs showcases variation in welfare states based on visual indicators

Very poor ⟷ Very good



Meet a virtual pig

bit.ly/virtual_pig

Students believe virtual pig workshops:

N = 33 postgraduate and N =15 undergraduate students enrolled in animal welfare courses

Are engaging, interactive and meaningful to their learning	**Support critical thinking about real-life welfare assessment**	**Encourage reflection on assumptions about good animal welfare**
Motivate them to actively participate and stay focused and attentive	**Motivate them to learn more about animal welfare**	**Increase their sense of preparedness to assess welfare on-farm**
Help connect theory and practice	**Increase awareness of the subjective nature of welfare assessment**	**Are a valuable substitute when farm visits aren't possible**

Virtual pigs

"I appreciated the safe space to make mistakes and learn without causing any real stress to animals"

"I was highly motivated to learn more about the pig industry and animal welfare"

Virtual pigs

- Can be a valuable alternative to live animals
- Enhance student experience using leading technologies
- Improve the way animal welfare assessment is taught
- Build skills for students' future careers and study
- Can help inspire the next generation of animal welfare scientists

Virtual tours

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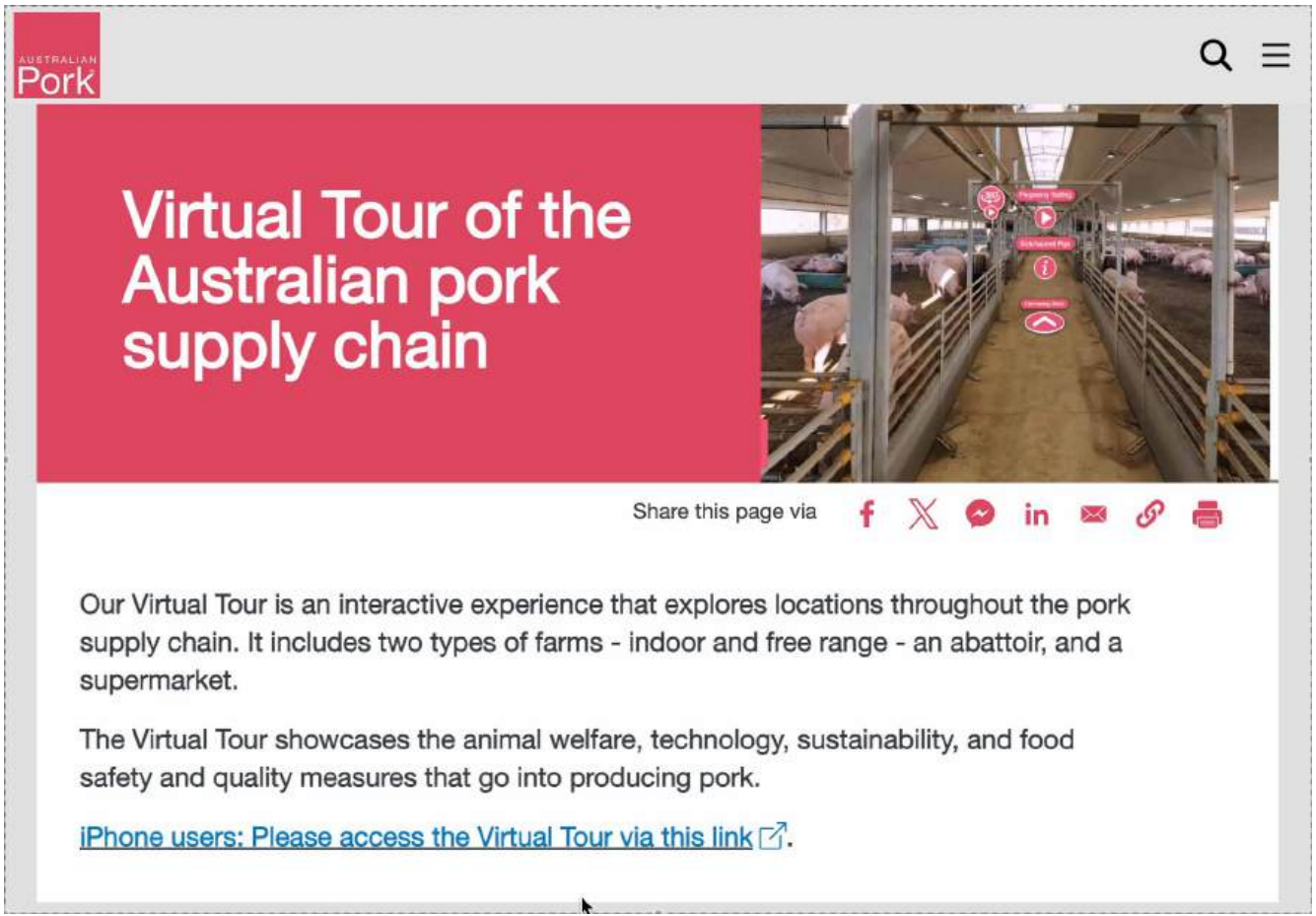
Virtual tours



Virtual tours

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Virtual abattoir designed to prepare veterinary students for in-person visits

DENOVA
VISUALISING TRAINING SOLUTIONS

Addressing the challenges in veterinary teaching

Find out how the University of Glasgow, the Royal Veterinary College, the University of Surrey, and Denova, developed the digital abattoir.

Virtual tours

University of Melbourne Dookie Campus VR

Video: Stuart Barber

Collaborative development of a 4D virtual farm between UniMelb, USyd, UQ, Murdoch & Massey

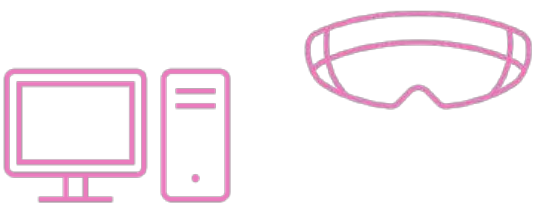
Hallein et al. (2025) JVME, 52(1)

Available to any vet school in Australasia

Virtual tours

Evidence of usefulness

- Teachers report that a game with a virtual walk through of a pig farm provided students with learning experiences that field trips couldn't [1]
- Some evidence that virtual farm tours change students' perceptions of welfare and their confidence to address issues [2]
    - E.g., Confidence to make recommendations to producers regarding pig and dairy welfare increased after tour



[1] Bunch et al. (2015) JHSE, 3(1), 2

[2] Anderson et al. (2025) JAAWS, 1-13

Augmented reality apps

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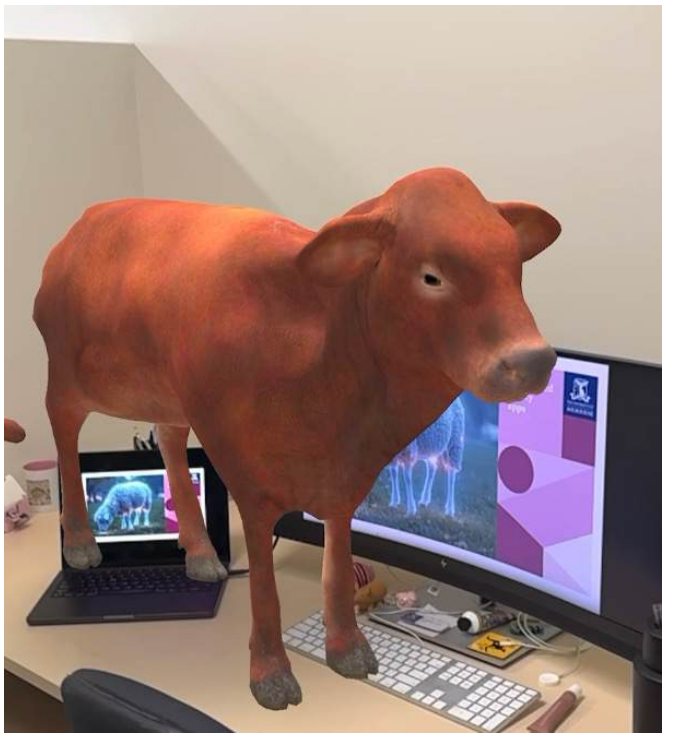
Augmented reality apps

Sheep and cattle disease detection apps from Think Digital

- **“Sheep EAD AR”**
- **“Cattle EAD AR”**



Mobile app for cow handling

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Mooving Cows

Development led by A/Prof Jennifer Van Os at The University of Wisconsin Madison [1]

Game-based learning

- Simulates facets of the real world
- Provides experiential exercises
- Strongly linked with increased student engagement, motivation and critical thinking [2]

[1] Van Os et al. (2025) J. Dairy. Sci. 108:8491–8507

[2] Plass et al. (2020) MIT Press

Mooving Cows

Evaluated with 3 student audiences via surveys

Primary and secondary students

n = 44
Played levels 1-3

Undergraduates

n = 101
Played levels 1-5

Veterinary Students

School of Veterinary Medicine
UNIVERSITY OF WISCONSIN–MADISON

n = 16
Played levels 1-8

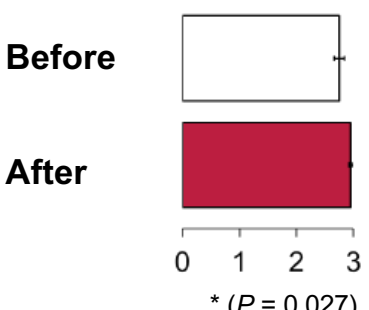
Van Os et al., in preparation

www.MoovingCows.org | jvanos@wisc.edu

Mooving Cows

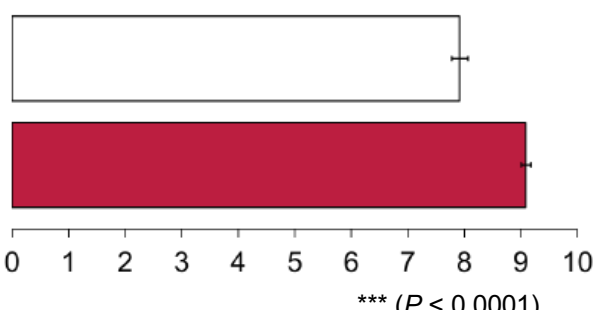
Number of correct multiple-choice answers before and after playing

Primary and secondary students



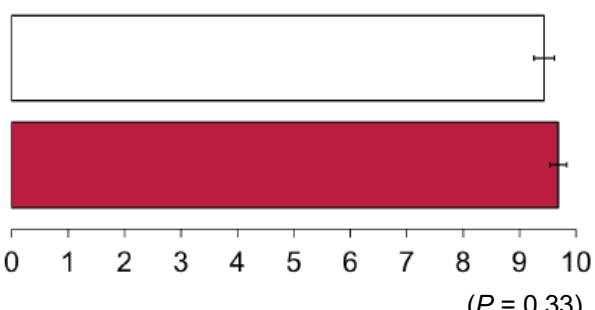
* (P = 0.027)

Undergraduates



*** (P < 0.0001)

Veterinary Students



(P = 0.33)

Van Os et al., in preparation

Paired t-test, separately for each student sample

www.MoovingCows.org | jvanos@wisc.edu

Mooving Cows

Student enjoyment of the game

Primary and secondary students

3.5 ± 1.2

Undergraduates

3.5 ± 1.3

Veterinary Students

4.1 ± 1.1

Van Os et al., in preparation

www.MoovingCows.org | jvanos@wisc.edu

Virtual reality cow handling

Image: cattlevr.com

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CattleVR

Development led by Dr Mandi Carr at Adelaide University in collaboration with Think Digital

Images: cattlevr.com

CattleVR

Development led by Dr Mandi Carr at Adelaide University in collaboration with Think Digital

Images: cattlevr.com

CattleVR

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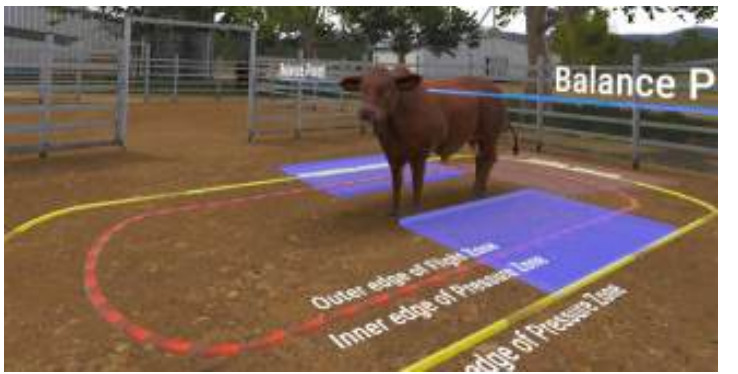
Insights into usefulness of CattleVR:

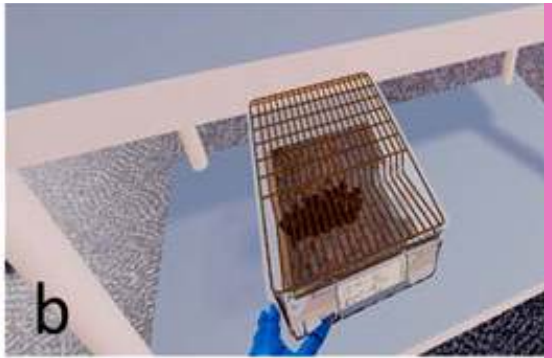
- Most students in animal-focused degrees at Adelaide University have no-little experience handling livestock, and report very low confidence in handling
- After CattleVR training, 95% of students report knowing where to stand to move cattle
- During live cattle handling, students that have completed CattleVR training can identify and correct their own mistakes
- Students that have completed CattleVR training were less likely to rush cattle



CattleVR

Virtual reality mouse handling

Image: Tang et al. (2021) Front. Educ. 6:710354



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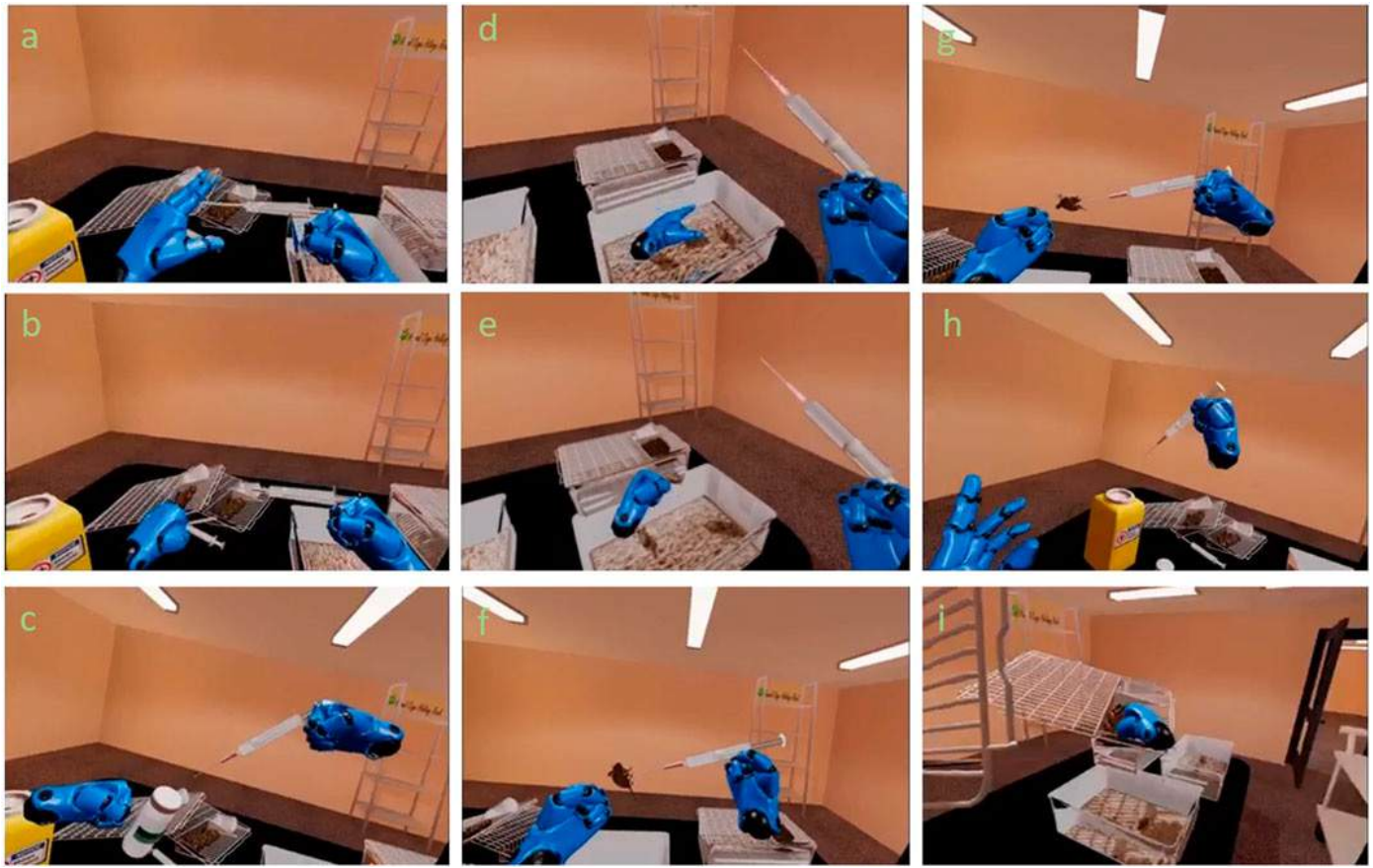
Virtual reality mouse handling



Tang et al. (2021) Front. Educ. 6:710354

Virtual reality mouse handling

Biomedical student experiences of using VR to learn animal handling:

- Students felt immersed in the simulation and reported that it provided them with hands-on experience, even through there were no live animals involved
- Students also shared that it allowed them to relate themselves as a researcher in handling real animals in a laboratory

Tang et al. (2020) Innov. Educ. 2(1),2
Tang et al. (2021) Front. Educ. 6:710354

Many other applications of VR and AR...

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Articles using VR and AR animal models 2002 - 2022

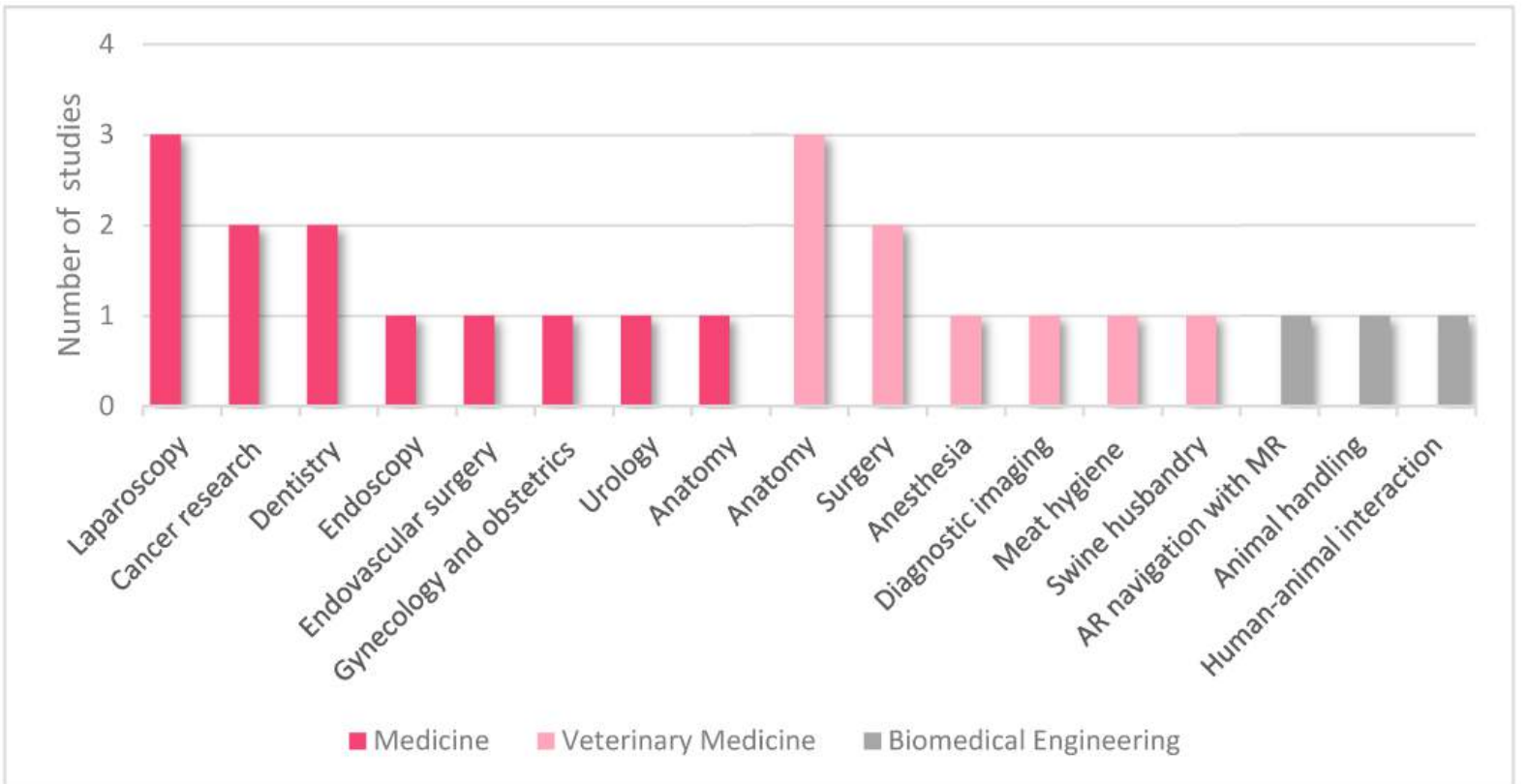
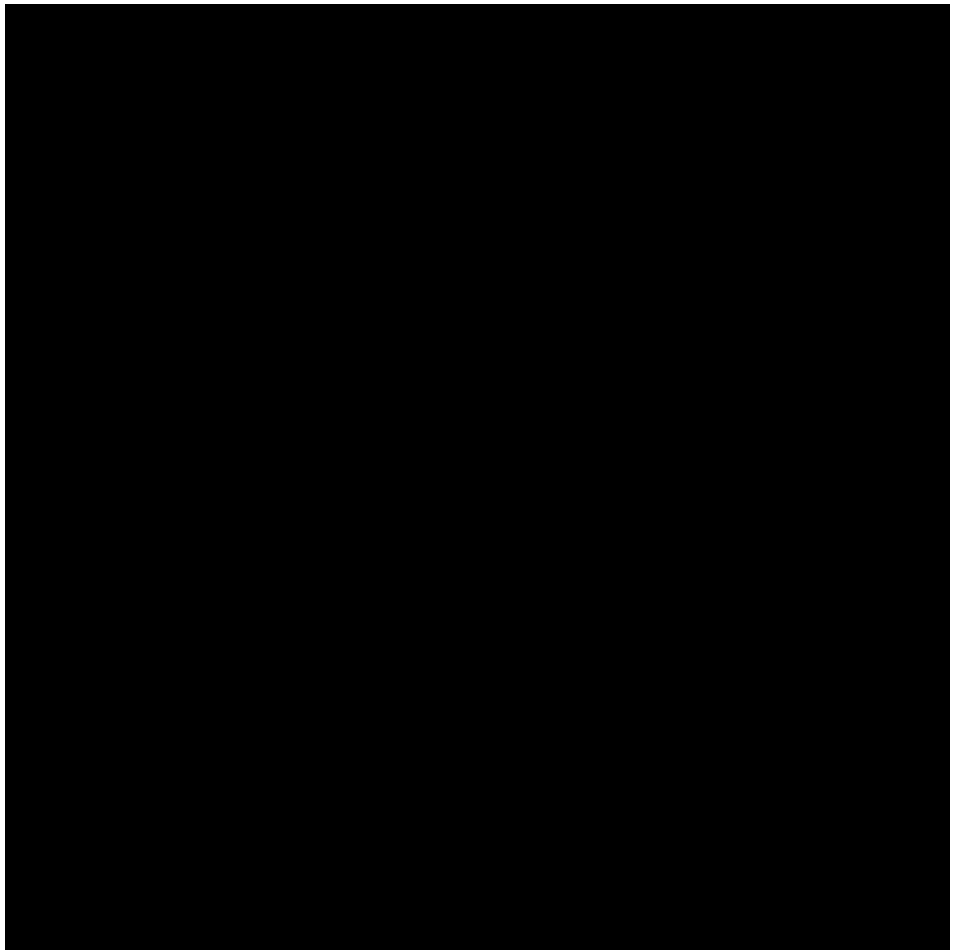


Figure: Aghapour and Bockstahler (2022) Animals 12(24), 3517

Local anaesthetic administration



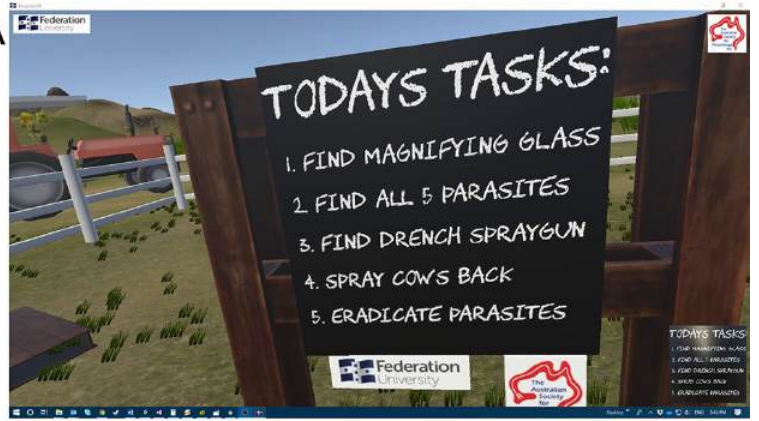
Development led by Navin Prakash at The University of Queensland

- Cattle and horses

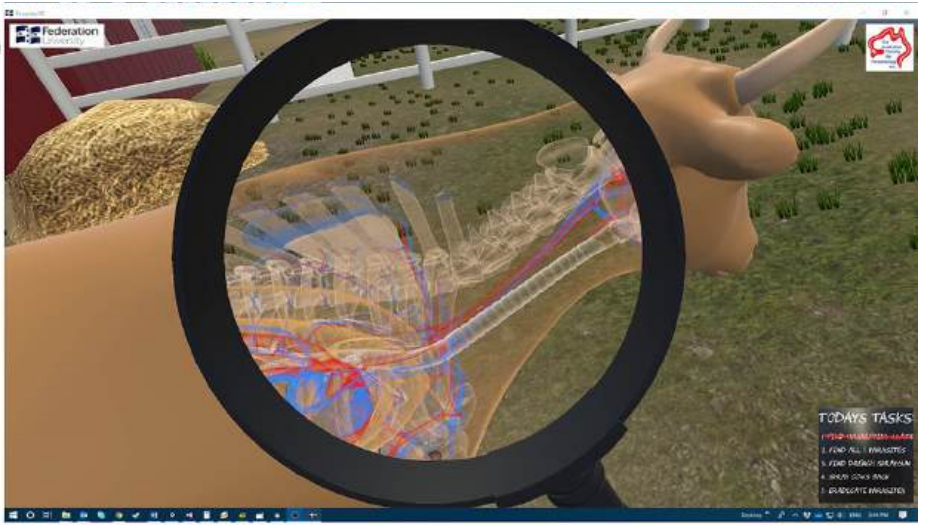
Prakash & Stewart (2025) Proceedings of the Australian Veterinary Educators Symposium, p13

Parasitology

A



B



C

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Dekker et al. (2024) Virtual Reality 28, 123

Image: Edge Innovations

The future?

Robots

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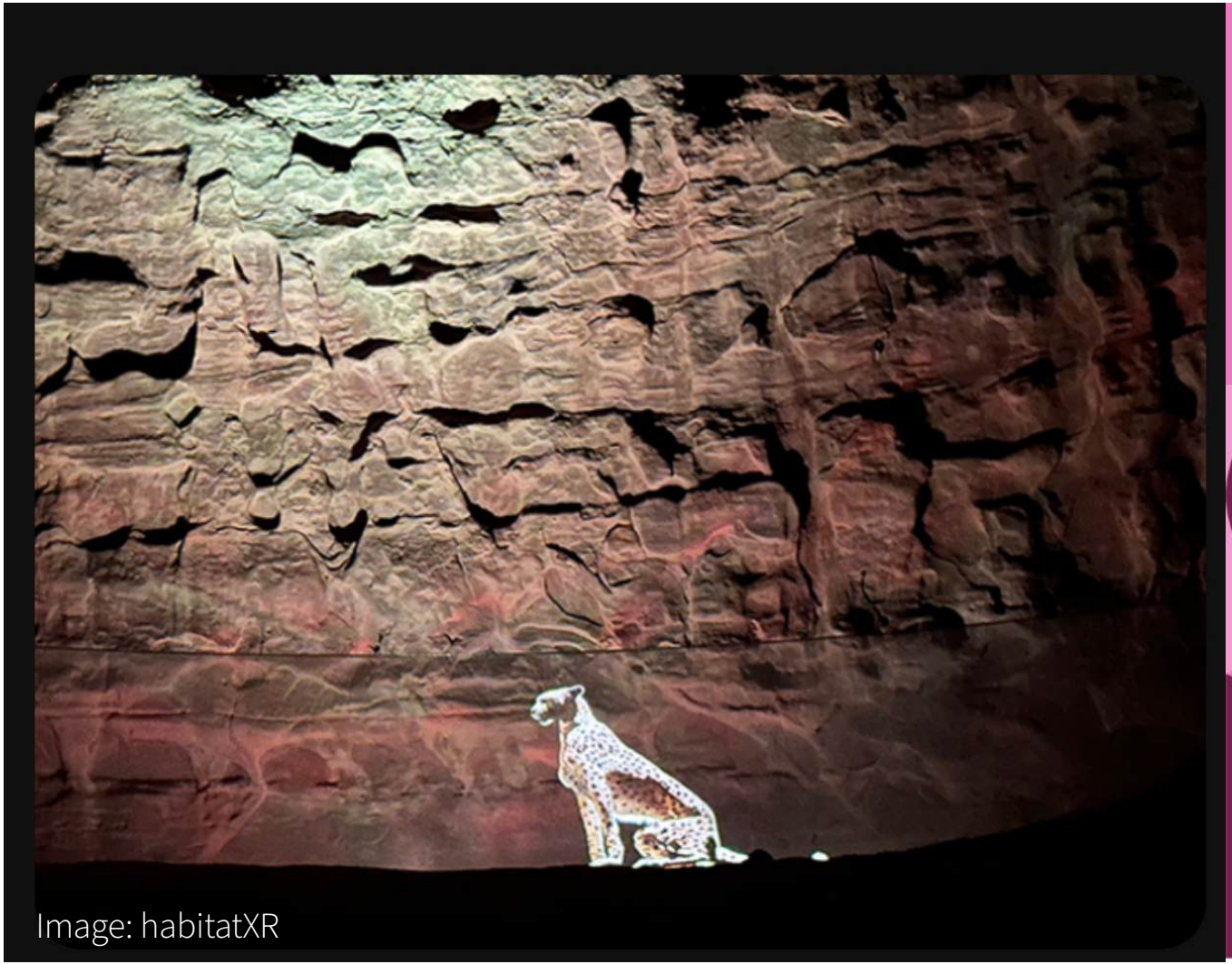

Image: habitatXR

The future?

Holograms

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Opportunities, risks & actions for educators

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Opportunities

- Free, user friendly, accessible opportunities for self-directed learning
- Can provide precise and immediate feedback for students
- Standardisation of learning and perhaps assessment
- Exposure to industries/animals students would not other experience
- Safe place for students to make mistakes and question routine animal use practices
- Where full replacement is not possible, opportunity to use digital tools to prepare students for live animal interaction

Risks

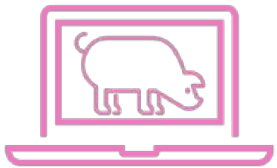
- Industry tools may present bias of information
- False replication of real-world conditions
- Skills may not fully transfer to live animals
- Tools need to be grounded in sound pedagogy and ensure they are still meeting intended learning outcomes
- Students may question whether virtual animals provide “real” training
- Less empathy for animals with less live animal contact?

Actions for educators

1. **Reflect on your current practice of using animals in teaching**
   - What is the actual welfare impact on animals? Students?
   - Where are there areas for improvement?
2. **Be an influencer if you believe your colleagues' practice can be improved**
3. **Identify if there are tools already available to enhance your teaching**
4. **If developing your own tools, consider collaboration and commercialisation**
5. **Publish your innovations and their impacts on students and animals!**

6. **Be transparent, and ensure there are clear policies in place for students to object to animal use**

Don’t be afraid of learning new things



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Acknowledgements

Mandi Carr, Jennifer Van Os, Stuart Barber & Navin Prakash for sharing insights into their innovations

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Digital resources

bit.ly/animal_tools