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Virtual Work Integrated Learning in Engineering

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SHAPING THE FUTURE OF TERTIARY EDUCATION

Virtual Work Integrated Learning in Engineering

Sally Male

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Agenda

1. Work integrated learning (WIL) and assessment in engineering in Australia
2. Problem with WIL in engineering in Australia
3. Vision for virtual WIL in engineering
4. Learning outcomes, assessment, and other requirements
5. Modules
6. Simulated workplace scenario
7. Safety in design using VR
8. Conclusions
9. Acknowledgements
10. Questions and comments

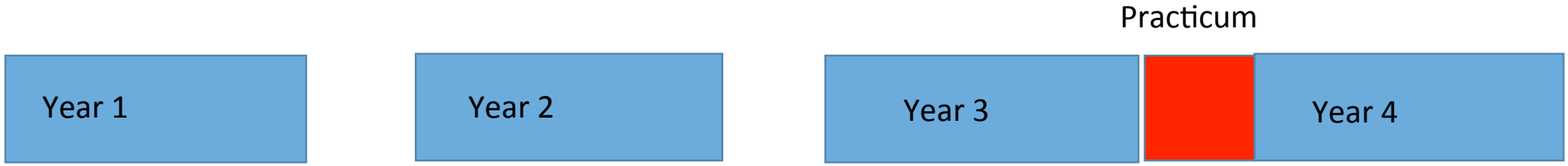
Two projects on work integrated learning in Australia:

Enhancing Industry Engagement in Engineering Education Project (2012-2014)
(Australian Council of Engineering Deans)
http://www.aced.edu.au/index.php/blog-3/projects

Gender Inclusivity of Engineering Students' Workplace Experiences (2015)
(Office for Learning and Teaching)
http://www.ecm.uwa.edu.au/students/learning/research/gender-inclusivity

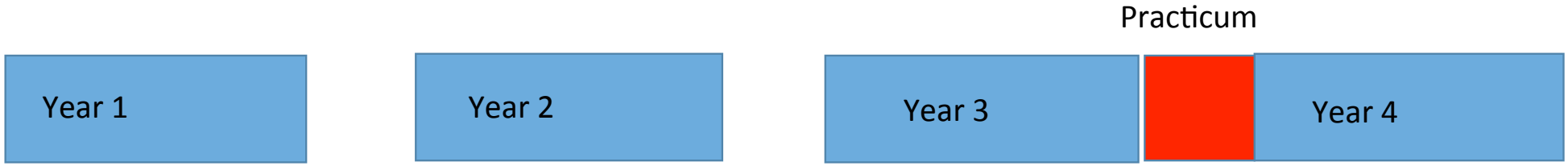
Work integrated learning in engineering in Australia

1. Program accreditation requirement for engagement with practice is commonly met through practicum late in program, often non-credit bearing
2. Practicums are often transformative
3. Assessment: reports, log books, and/or portfolios, often pass/fail



Common problems with traditional engineering practicum

1. Poorly resourced and assessed
2. Unreliable
3. Students can be vulnerable
4. Limited diversity in a single practicum
5. Often completed late in degree programs
6. Difficult to secure



Virtual WIL aim

Engineering students will experience the transformative benefits of work integrated learning without a real placement.

Vision for virtual WIL in engineering

Students will complete authentic engineering projects by:

- accessing a virtual environment that simulates an engineering site
- receiving feedback from industry-based engineers and
- reflecting individually and with others.

Students will electronically access real or simulated sites or equipment, and/or practitioners.

Learning outcomes

1. Development contributing to Stage 1 Competencies
2. Self-directed learning
   a. understanding of engineering roles and value of engineering
   b. motivation towards engineering studies
   c. self-efficacy for working as an engineer
   d. an identity as a student engineer
   e. ownership of responsibility for learning
3. Career literacy
   a. improved capability to secure or create engineering work
   b. understanding of the employment market in the student's discipline
   c. capability to plan navigation of the employment market including lifelong learning, and
   d. an expanded engineering network.

Requirements: The Suite of Modules Should…

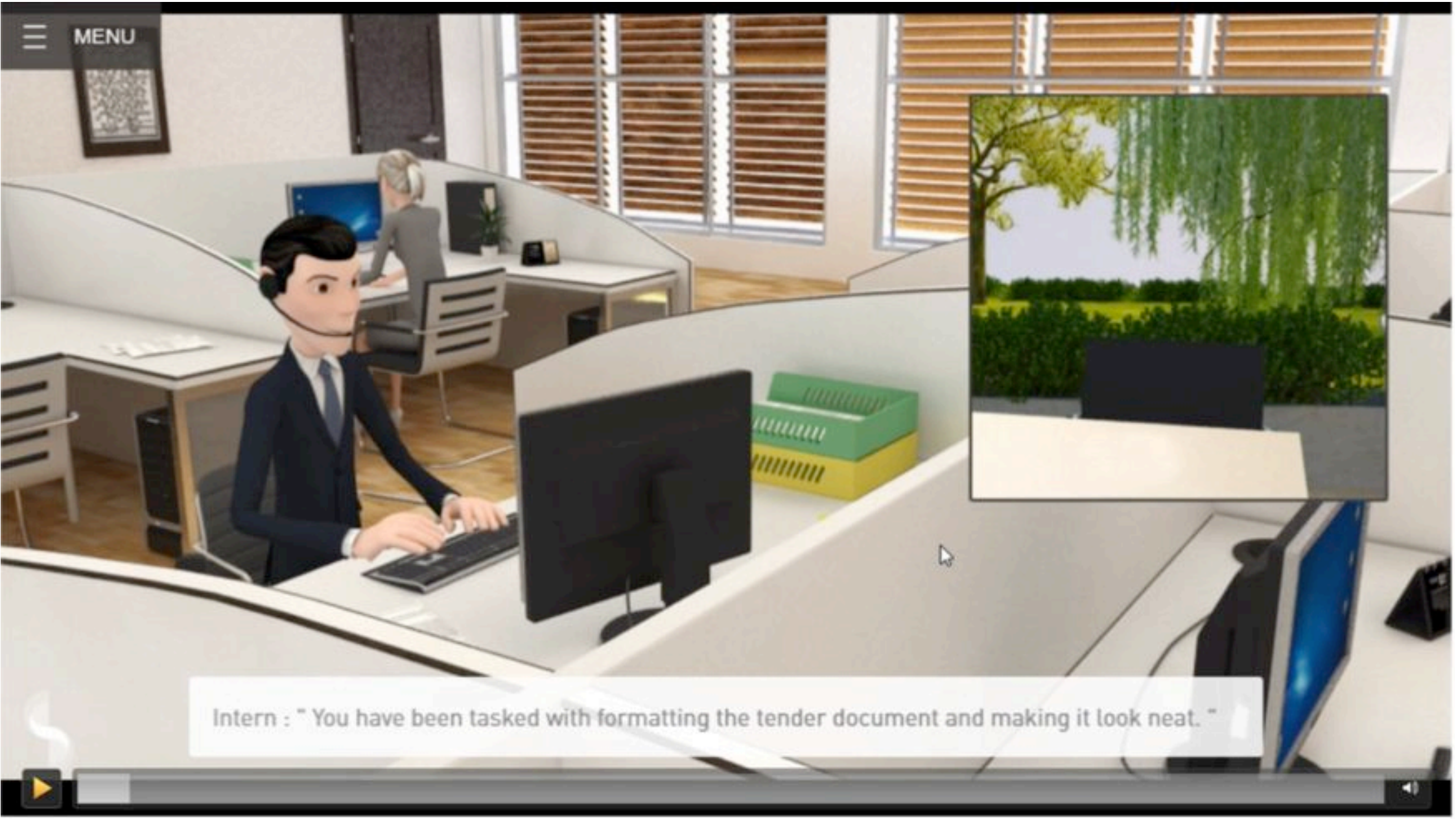
1. include realistic disruption and uncertainty
2. be structured with progression from first to final year with increasing authenticity and autonomy
3. support development of sociotechnical, practical and financial learning outcomes including capabilities to practise ethically, safely and sustainably
4. use authentic engineering processes
5. include modules within units (integrated), and include stand-alone modules
6. **accommodate local assessment mechanisms, rather than including assessment**.

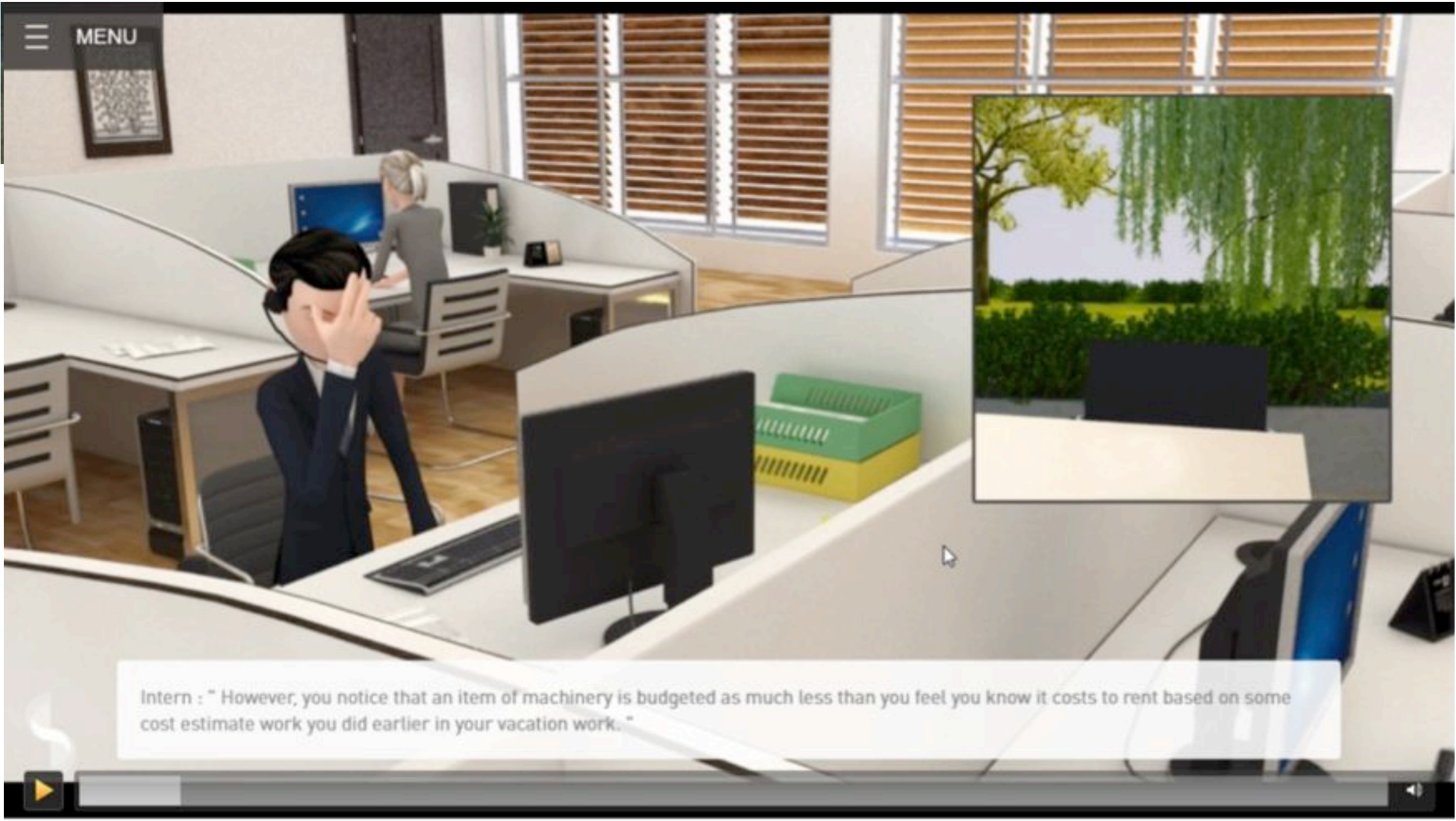
Planned Modules

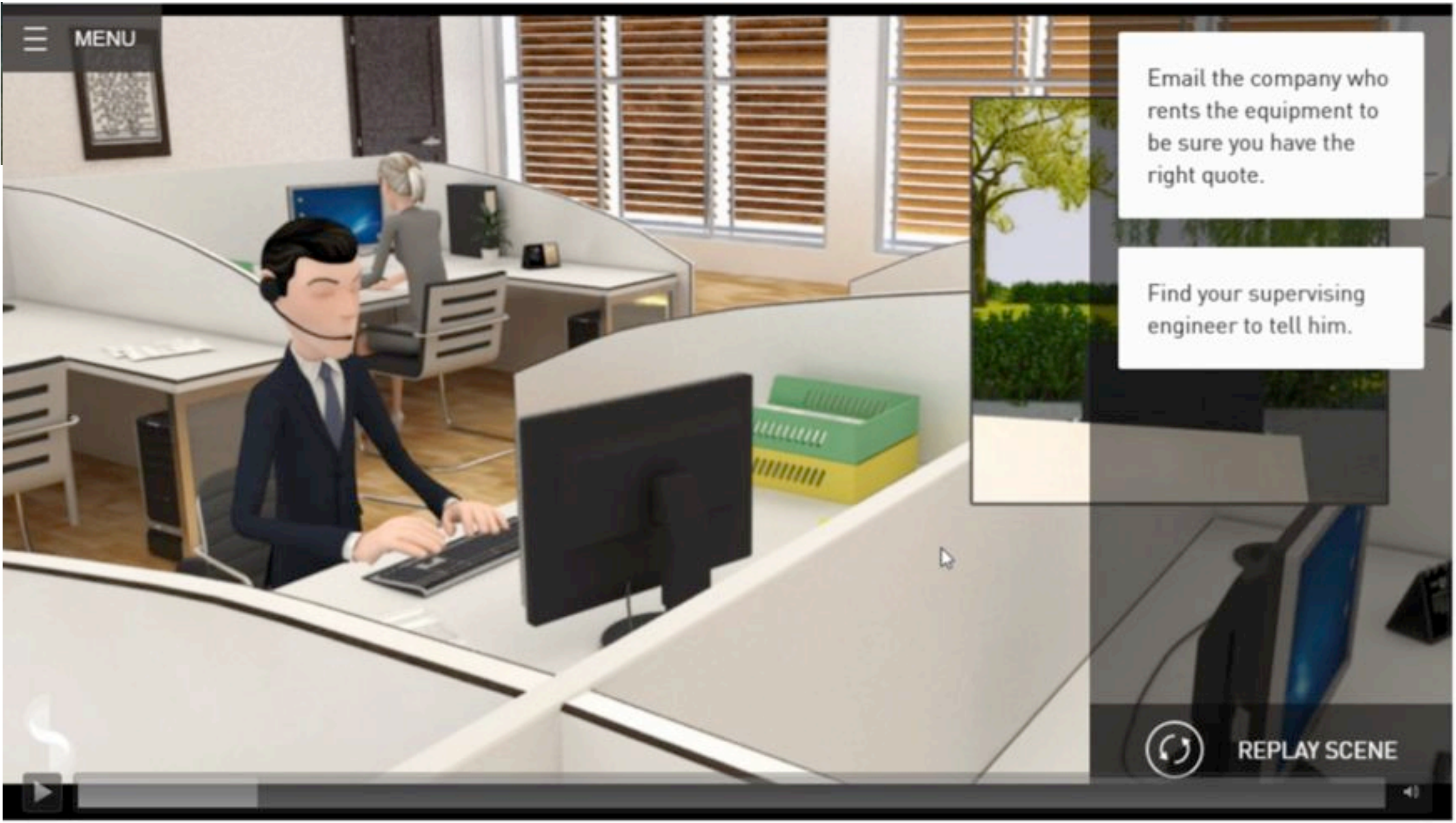
1	**Career literacy** – interview and be interviewed by an engineer	Integrated or stand-alone in years 1/4/5
2	**Engineering communication/self-management** – simulated authentic scenarios and reflection electronically with team and engineer	Integrated in years 1/2/3
4 **5** **6**	**Safety and risk** – various types of safety meeting with an engineer after visiting virtual environment	Integrated or stand-alone in years 3/4/5
7	**Maintainability** – pump isolation in virtual site and discussion with engineer	Integrated or stand-alone in years 3/4/5
8 **9**	**Tender preparation and evaluation** – prepare a tender in a team with guidance from junior engineer and report to senior engineer, likewise evaluate tenders	Stand alone in years 3/4/5

Example: simulated scenario on self-management in the workplace

1. Students make decisions in a simulated workplace scenario (following slides)
2. Students reflect with a professional engineer mentor through a web connection
3. Assessment is aligned with the unit in which the learning activities are integrated


MENU
Intern : " You have been tasked with formatting the tender document and making it look neat. "


MENU
Intern : " However, you notice that an item of machinery is budgeted as much less than you feel you know it costs to rent based on some cost estimate work you did earlier in your vacation work. "


MENU
Email the company who rents the equipment to be sure you have the right quote.
Find your supervising engineer to tell him.
REPLAY SCENE

Poll 1

Have you experienced virtual reality?

Poll 2

Have you used virtual reality in your teaching?

Example: safety in design using virtual reality (VR)

1. Used VR to teach safety in design
2. 280 engineering students in 2 units (ELEC5551 and MECH5551)
3. Authentic case and process (Construction Hazard Analysis Implementation Review (CHAIR)), identified in collaboration with Safe Work Australia, regulatory authorities, and safety engineers: Mike Hurd and Mike Dean
4. Students completed CHAIR template before using VR, after using VR, and after reflection as a team with industry-based supervisor
5. Problem: how to use VR with large cohorts
6. Solution: one student in each group wore headset and interacted in VR and others observed and discussed

Assessment integrated into formative assessment of project management (ELEC5551)

Table 1. Assessment Rubric for Project Management

	Insufficient to assess	Basic	Developing	Proficient	Advanced
Liaison with team and others	0 points Did not organise anything	5 points Arranged something	6 points And provided one or more clear agendas	7 points And agenda included items relevant to the project schedule	8-10 points And communicated clearly and politely
Chairing meetings in the period	0 points Did not chair	5 points Led the team through the agenda	6 points And listened actively	7 points And provided opportunity for all team members to contribute	8-10 points And summarised actions, and inspired the team to achieve timely completion
Minutes	0 points Did not prepare or share minutes	5 points Prepared minutes	6 points And shared minutes within 3 uni days of the meeting	7 points And minutes were clear and concise	8-10 points And actions were included

Table 3. Assessment Rubric for Teamwork and Professionalism in Weeks 7 to 12

	Insufficient	Basic	Developing	Proficient	Advanced
Contributing to the work of the team	0 points Did no preparation	5 points Contributed to project work or organisation of the team at a basic level	6 points Contributed to the work or organisation of the team at a valuable level	7 points Contributed proficiently to work or organisation of the team	8-10 points Contributed to work or organisation of the team at an advanced level
Interacting professionally	0 points Did not listen or communicate with the group	5 points Listened and communicated	6 points Contributed ideas and cooperated	7 points Contributed by communicating professionally and supporting others to contribute	8-10 points Inspired the team or supported the team over a hurdle
Keeping a notebook	0 point Insufficient to assess	5 points Made brief sporadic entries	6 points Regularly made significant entries and complete professional performance analysis templates	7 points Kept a well-organised notebook with multiple entries every week including notes and diagrams about design decisions, project management, communication with the project partner, and notes on safety in design and the design review meeting.	8-10 points Kept a comprehensive well-organised notebook including notes and diagrams about design decisions, project management, prepared questions for and actions from the design review, and reflective writing (at least 100 words per week).

Assessment integrated into self-assessment of workshop preparation (MECH5551)

Students completed preparation, and rated this using a marking rubric. The industry-based supervisor checked the students' self-ratings.

Assessment integrated into final report (ELEC5551)

Expected item in final design report:

Safety issues identified, processes such as development of prototypes or meetings used to identify them, and mitigations

Key result of trial with large student numbers

Recall from earlier:

1. Problem: how to use VR with large cohorts
2. Solution: one student wore headset and interacted in VR and others observed and discussed

Result:

Students identified additional hazards after accessing the VR site by wearing the headset and using the hand-pieces, or by observing.

Participants and Responses

In Electrical & Electronic Engineering Design Project 1 ELEC5551

117 responses from 131 students who attended

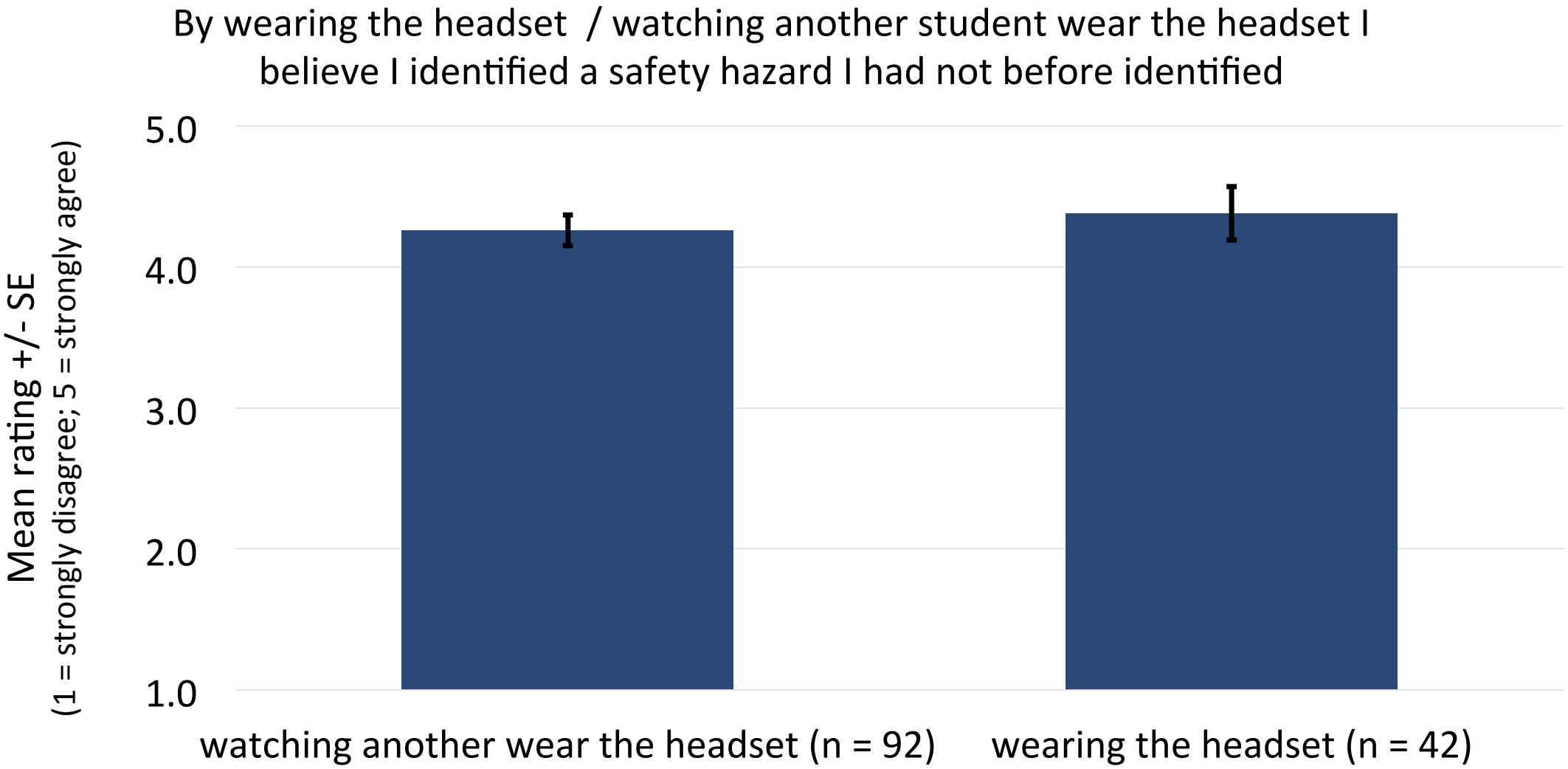
(including 20 female)

In Mechanical Engineering Design Project 1 MECH5551

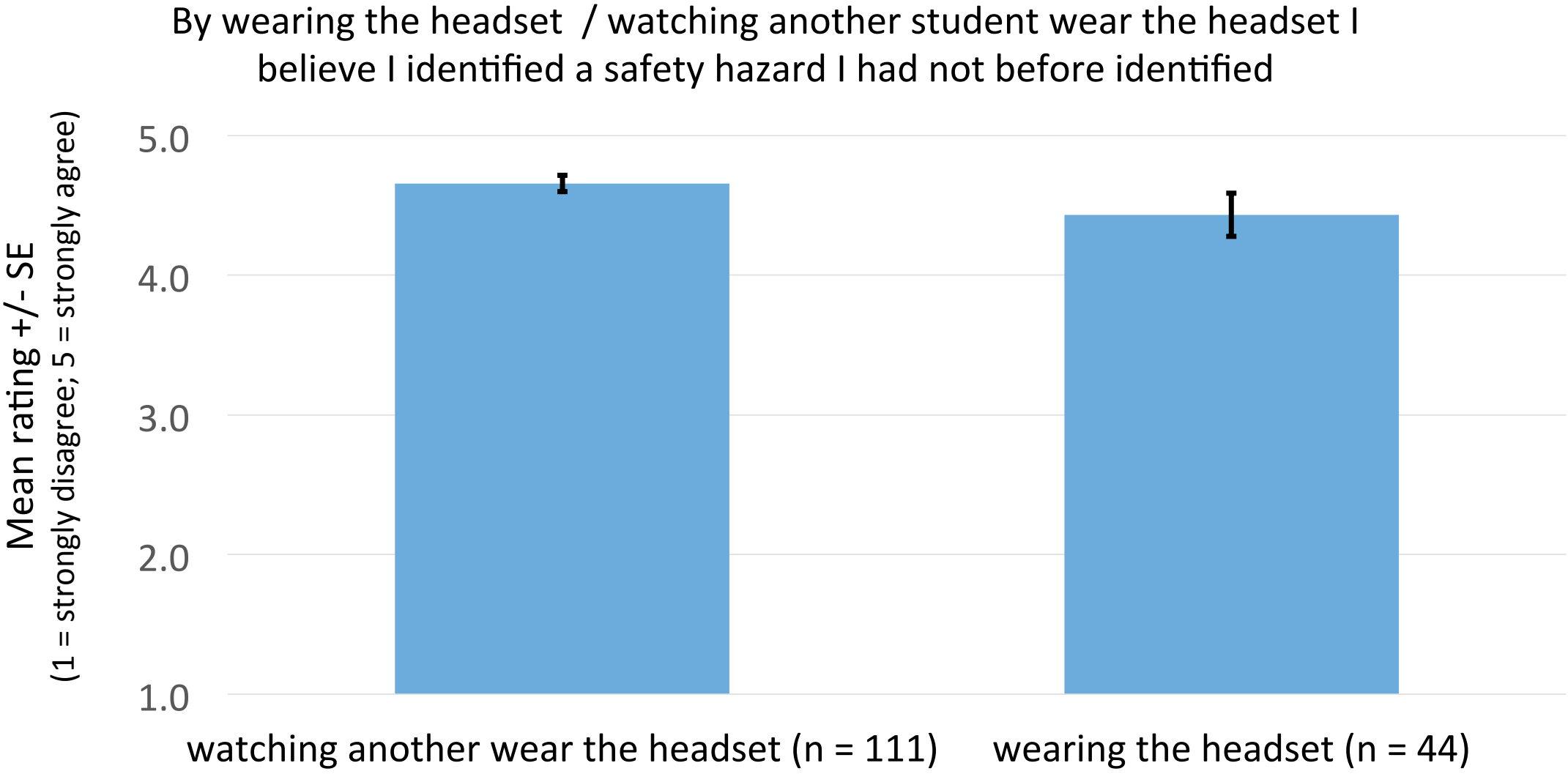
140 responses from 149 students who attended

(including 20 female)

ELEC5551


By wearing the headset / watching another student wear the headset I believe I identified a safety hazard I had not before identified
Mean rating +/- SE
(1 = strongly disagree; 5 = strongly agree)
5.0
4.0
3.0
2.0
1.0
watching another wear the headset (n = 92)
wearing the headset (n = 42)

MECH5551


By wearing the headset / watching another student wear the headset I believe I identified a safety hazard I had not before identified
Mean rating +/- SE
(1 = strongly disagree; 5 = strongly agree)
5.0
4.0
3.0
2.0
1.0
watching another wear the headset (n = 111)
wearing the headset (n = 44)

Conclusions

1. Numerous opportunities exist for non-placement WIL using electronic or simulated access to workplaces and practitioners.
2. These can provide reliable, diverse, structured engagement with workplaces, authentic processes and practitioners, from first to final year, with increasing authenticity and autonomy.
3. Development and testing of feasibility and efficacy continue.
4. Access to practitioners through Engineers Australia is likely to be invaluable.
5. The team has one more year to continue development and testing, and establish sustainable implementation.

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Webinar Session feedback

With thanks from your hosts

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Recording available
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