

2026-27 HIVE Summer Internship Project

Cutting Edge Safety: A Virtual Induction for Anatomical Pathology & Microtomy Training

Primary Academic Supervisor

Dr. Nur Dianah Abu Bakar

Project Background

The anatomical pathology (AP) facility at Curtin University processes tissue specimens through fixation, embedding, sectioning and staining for microscopic analysis. Histopathology, a division of AP, supports diagnostic training within the Bachelor of Science Laboratory Medicine degree. A key skill is confident, safe use of the rotary microtome, which uses an exposed, extremely sharp blade at close range to cut paraffin-embedded tissue into four-micrometre slices, alongside hazards from the chemical reagents and solvents used in sectioning.

The semester's first practical session is a dedicated safety induction covering hazard controls, chemical safety and correct microtome technique, including locating safety infrastructure (shower, eyewash station, first aid kit, spills kit, fume cabinet) and segregating sharps, biohazard and general waste. This is supervised (typically one staff to five students), though blade injury risk remains real even with supervision.

Sharps injuries from rotary microtome blades are among the most reported incidents in histology and research laboratories internationally, with near misses (e.g. an unlocked rotary arm, missing blade guard, unsecured block) as common precursors. The in-person approach is effective but hard to scale, inconsistent between sessions, and offers no way to safely rehearse hazard recognition beforehand.

A growing evidence base supports immersive, visualisation based training as an alternative. Studies in radiation safety, anatomy education, PPE use and industrial safety show virtual training matches or outperforms didactic methods for procedural skills and hazard recognition, while letting trainees safely encounter scenarios that cannot ethically be staged with a real

blade or lab risk. This project aims to provide a virtual laboratory platform paired with a dedicated module on the occupational health and safety (OHS) measures required in histopathology.

Project Description, Expected Outputs, Possible Stretch Goals

The aim is to design and build an interactive virtual platform accessible via Curtin's LMS system and available on several mobile devices including laptops, desktops and mobile phones. This virtual platform should be available as browser-based and accessible on HIVE displays and loaned VR headsets that lets students and staff explore the anatomical pathology facility and safely rehearse rotary microtomy sectioning techniques and chemical hazard recognition before stepping into the real laboratory environment.

Expected outputs:

- A maneuverable 3D/360 walkthrough of the facility (captured via VR-180/photogrammetry), with interactive hotspots on equipment, hazard zones and PPE stations.
- A dedicated interactive module walking through correct use of the rotary microtome including how to load a paraffin block and microtome blade, trim the block to expose tissue, section at 4µm, and correctly handle, dispose of and decontaminate the disposable blade.
- Embedded "spot the error" hazard checkpoints (e.g., unlocked rotary arm, missing blade guard, incorrect blade disposal).
- An embedded questionnaire/knowledge check tracking individual student progress and comprehension.

Possible stretch goals:

- Browser-based version, converting the VR-180 capture to equirectangular format for desktop/mobile access.
- Branching decision-point scenarios where user choices affect outcomes (e.g., consequence of skipping a safety step).
- Basic analytics (completion time, checkpoint errors) to evaluate induction effectiveness and common mistakes.
- Extending the same capture/asset pipeline to a second instrument or hazard area.

Links to background reading and any relevant recent work in the field

- <https://pmc.ncbi.nlm.nih.gov/articles/PMC12331925>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC12449611/>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7183109/>

What type of visualisation will the student develop or produce?

- The student will produce a VR-180 capture of the histopathology laboratory and rotary microtome technique, built primarily as an immersive HIVE Dome walkthrough with interactive hotspots.
- A branching "spot the hazard" module covers key safety checkpoints (blade guard, handwheel lock, waste disposal).
- The application will support HIVE VR headsets for individual immersion, with a browser-accessible 360 version for laptop/PC access.

How will the visualisation contribute to your research outcomes?

- This visualisation replaces supervisor-dependent induction with a standardised, scalable module completed before students' first supervised session.
- Expected outcomes include reduced sharps injury risk and more consistent onboarding.
- Embedded hazard recognition checkpoints and a dedicated rotary microtome skills module let students build hazard identification competency in a consequence-free environment before facing real risk in their first supervised session

If the project is successful, where would you consider publishing the results?

BMC medical education or Focus on Health Professional Education

Draft Project Timeline:

Week 1

Nov 16 - Full day HIVE induction

Nov 17 - Area and Project Induction with Primary supervisor

Develop project plan with HIVE and academic team

Literature and relevant project review

Project Familiarisation

Week 2

Finalise literature review; facility hazard mapping workshop with supervisor and/or technical staff to confirm priority safety checkpoints; begin facility photography/photogrammetry capture

Week 3

Complete facility capture; film VR-180 stereoscopic footage of correct microtome technique with facility staff; set up Unity project and import test photogrammetry model

Week 4

Process photogrammetry in Metashape; clean and optimise 3D mesh in Blender for lightweight browser performance; begin building the facility walkthrough environment in Unity

Week 5

Continue walkthrough build: navigation, interactive hotspots, initial video integration; checkpoint demo to supervisor

Week 6

Construct microtome interactive module (step-by-step sequence); add first hazard recognition checkpoints; first WebGL/browser test build

Week 7

Cross platform testing (laptop browser, HIVE display, and/or VR headset); bug fixing and refinement; small internal pilot with a few students/staff for feedback

Week 8

Finalise module and lock the build; final QA pass

Week 9

Focus on report writing and presentation (including demo) preparation

Week 10

Focus on report writing and presentation (including demo) preparation

5th Feb Final Showcase Day and final report due

Student Experience and Supervision:

How often will you meet with the student over the 10-week period?

Minimum of twice per week- Dianah

Your work desk location and the location of student desk

TBC

Student Attributes:**Please indicate any preference for student's academic discipline or field of study**

Open to students from either Computer Science, Games Design/Interactive Media, or a related visualisation/software discipline (for the technical build: Unity, 3D asset pipeline, WebGL/WebXR export), OR Laboratory Medicine/Biomedical/Medical Science (for direct familiarity with the facility, specimens and safety context). A student pairing both - e.g. Laboratory Medicine with a strong self taught or elective interest in 3D/game development would be ideal but is not required, as domain knowledge will be provided directly by facility staff throughout the project.

What competencies are required to start this project

Beginner - 2D art/editing

Intermediate - Video production/editing

Intermediate - 3D modelling software (Blender, 3ds Max)

Intermediate - Game engine development (Unity, Unreal. Godot, etc.)

Intermediate - Virtual Reality Development (rendering pipelines, scene content design, interaction)

Intermediate - Photogrammetry / 3D capture (e.g. Metashape, RealityCapture) — the tool itself is user friendly, so willingness to learn is enough, but prior exposure helps given the tight schedule

Do you have any other student attributes you think are important to the project?

Comfortable working in a wet lab/biohazard environment (tissue specimens, blades, formalin). Meticulous about technical accuracy over visual polish, this is safety training content, and must default to checking with facility staff rather than assuming. Self directed, fast, independent learner of new software (Unity, Blender, Metashape). Able to translate expert/technical knowledge into plain instructional content for a first time user.