The creation, use and evaluation of 3D technology in undergraduate midwifery education

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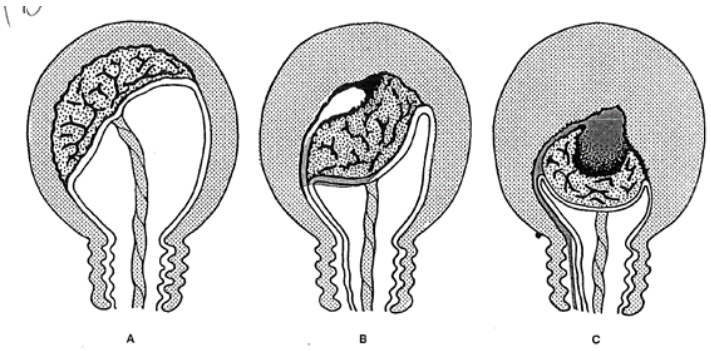
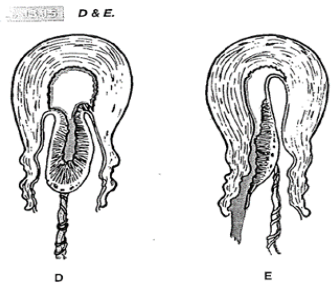
Overview

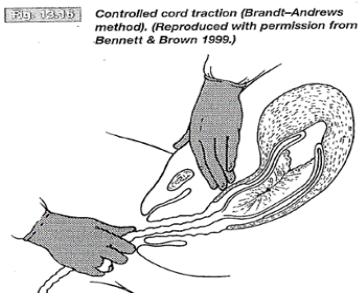
- The issue that generated the creation of the 3D teaching and learning artefact
- The aim and objectives of the innovation
- The explanation of the process of creating the 3DMVR
- Implementation and initial evaluation results with students at USC
- Pilot Research Project at CDU
- Findings/Results
- Recommendations

The Issue

- There was a lack of suitable resources to teach some complex subjects within midwifery.
- Book illustrations do not provide comprehensive illustrations of normal physiological recovery after birth.
- Many people find it difficult to understand concepts from text book readings alone preferring visual representations.





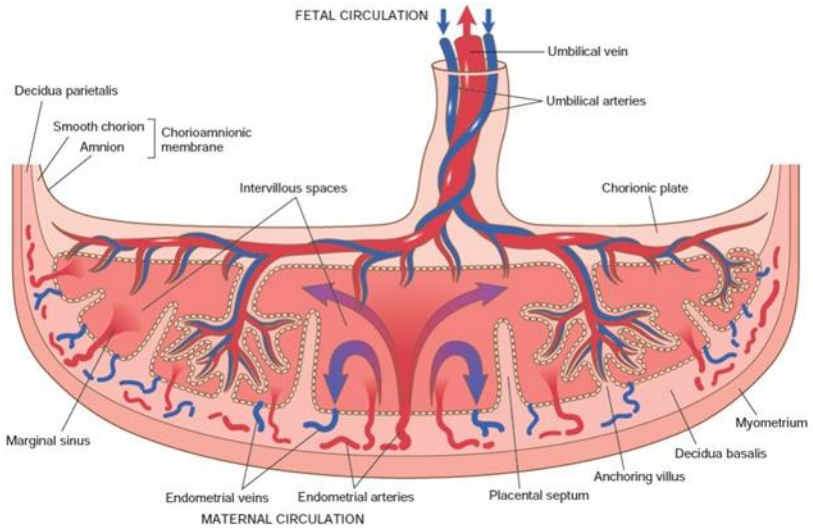


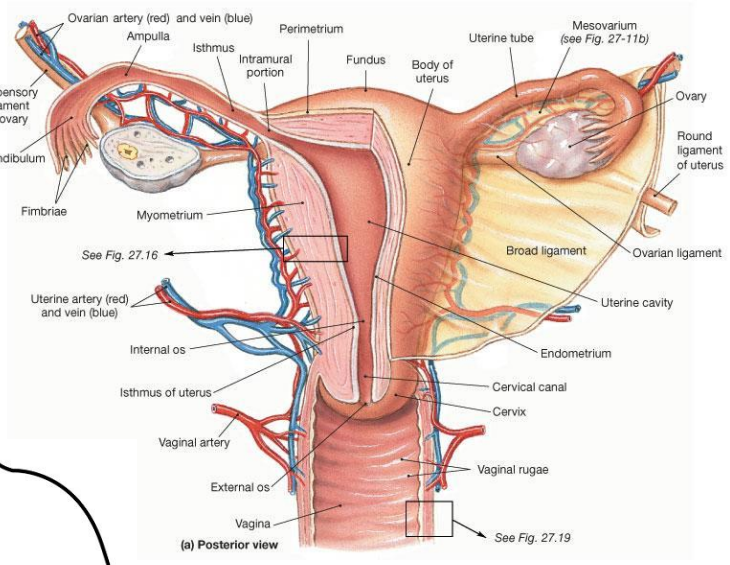
Explanation of the aim of creating the 3D Midwifery Visualisation Resource (MVR)

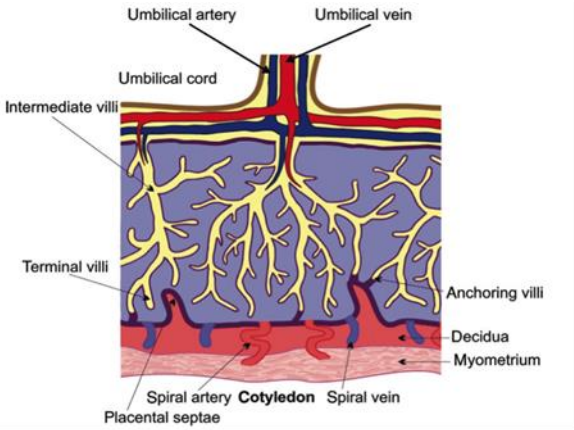
- To overcome the lack of resources by creating customised audio/visual resources
- Use new technologies that appeal to 21st century learners
- Use 3D technology to make images move in realistic time sequences

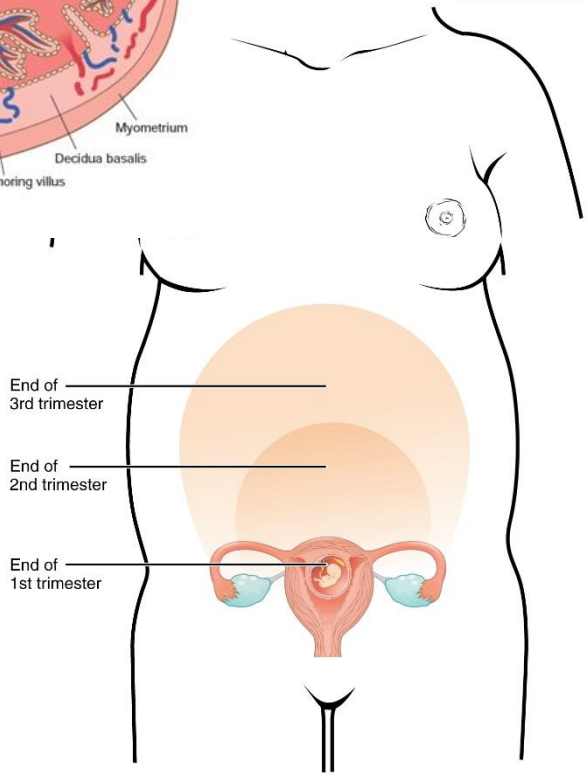
- The midwifery artefact provides students with a visual representation of the internal anatomical layers of the muscles, blood vessels and placenta and membranes.
- The artefact simulates the expulsion of the placenta and membranes and shows the normal physiological response of how the blood vessels contract to prevent haemorrhage.
- Finally. the artefact demonstrates how the uterus involutes as it retracts back into the pelvis over the course of the postnatal period.

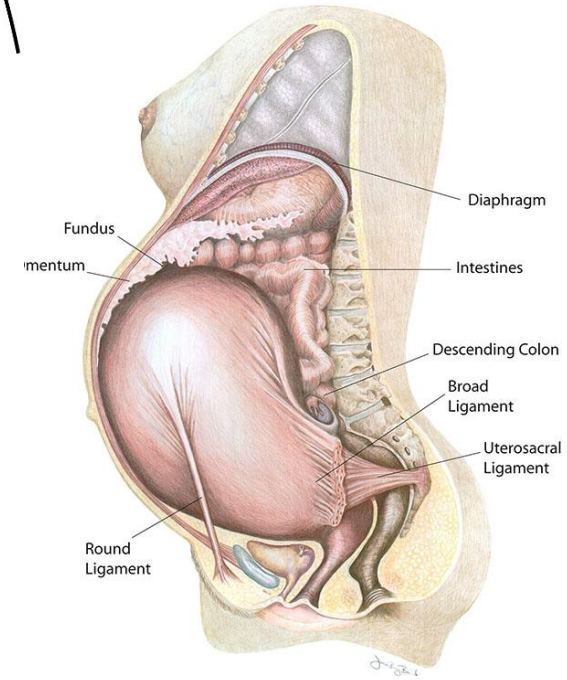
Google Images

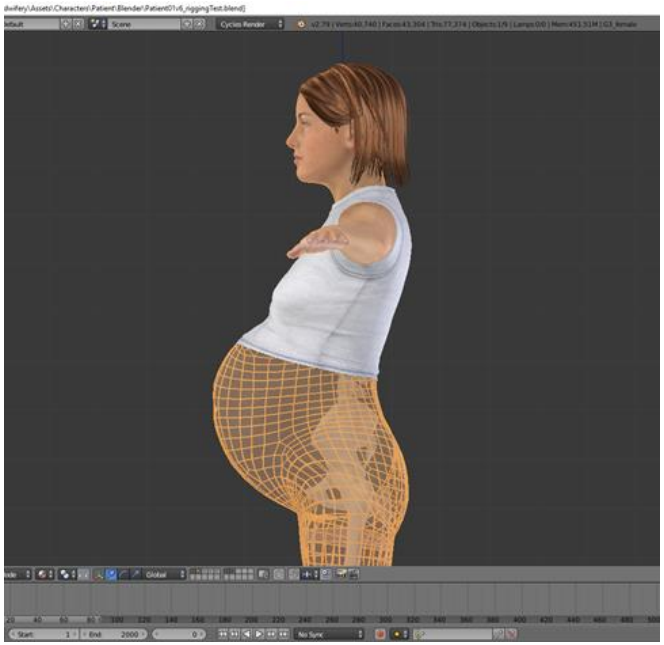


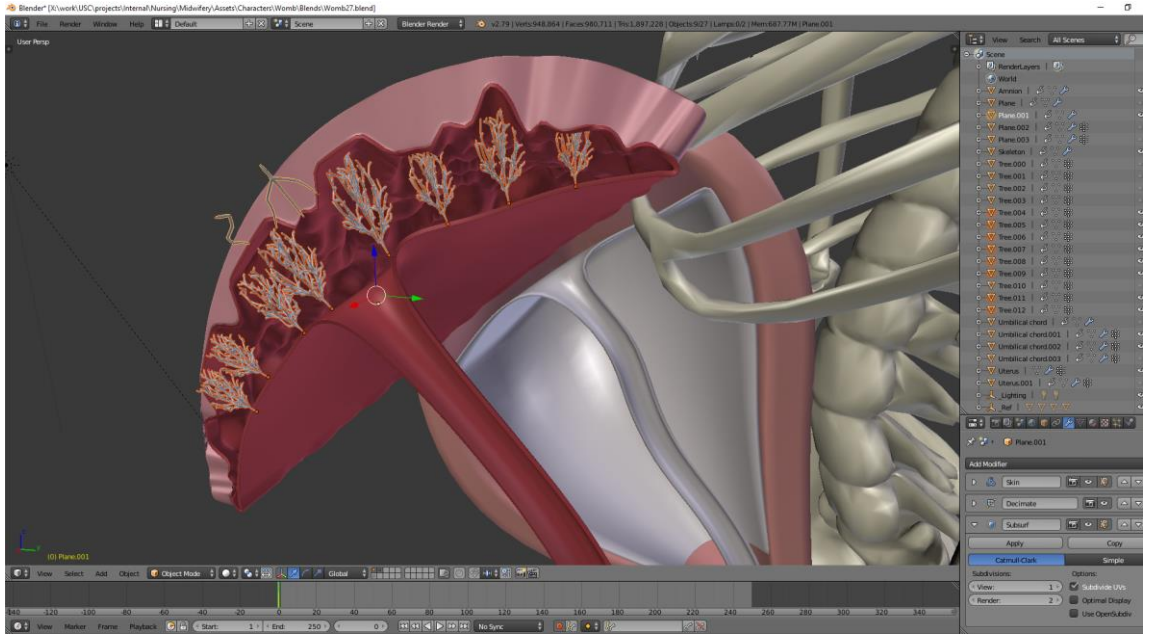


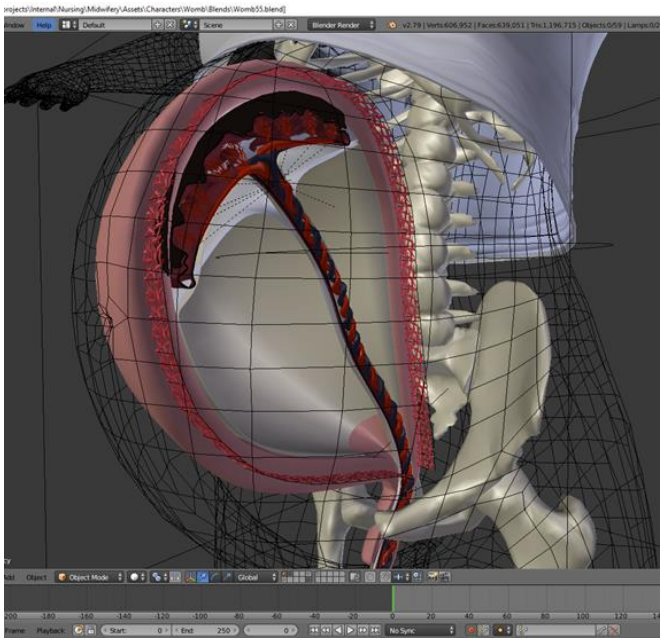






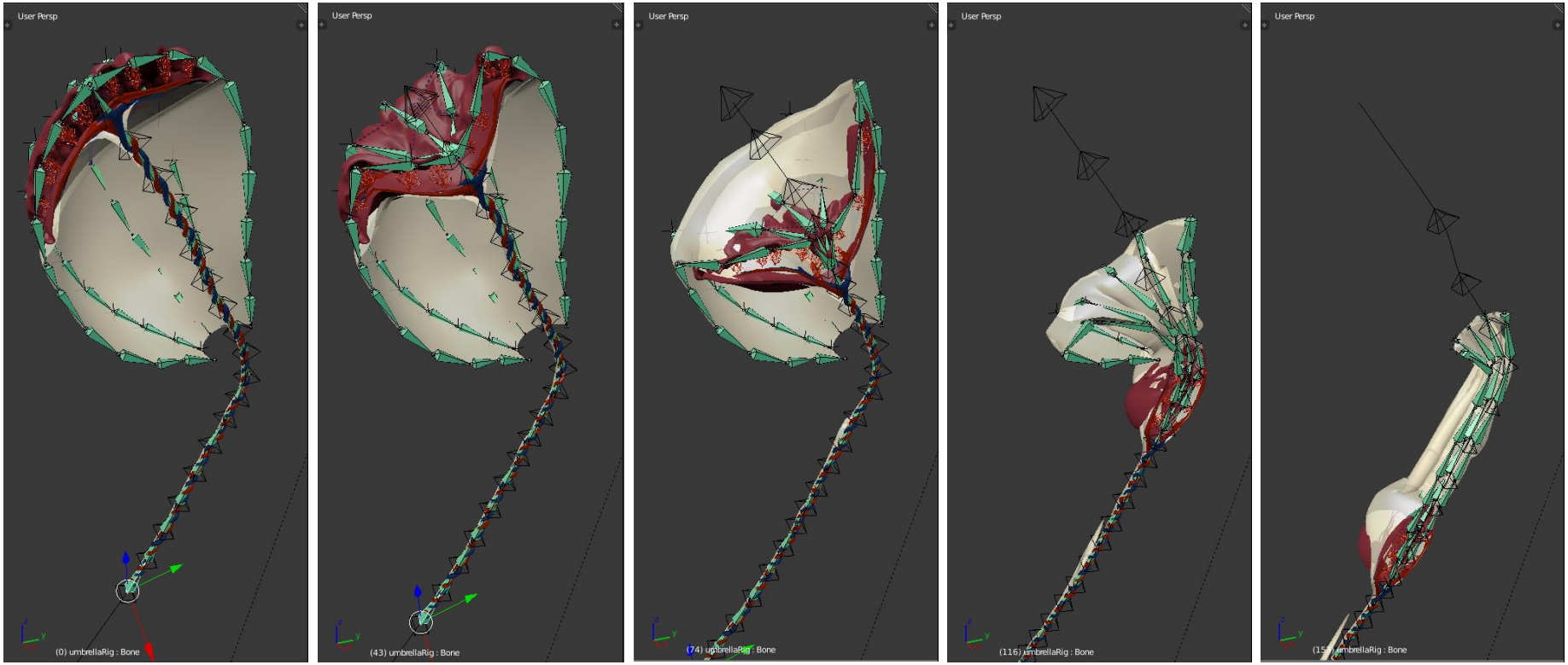




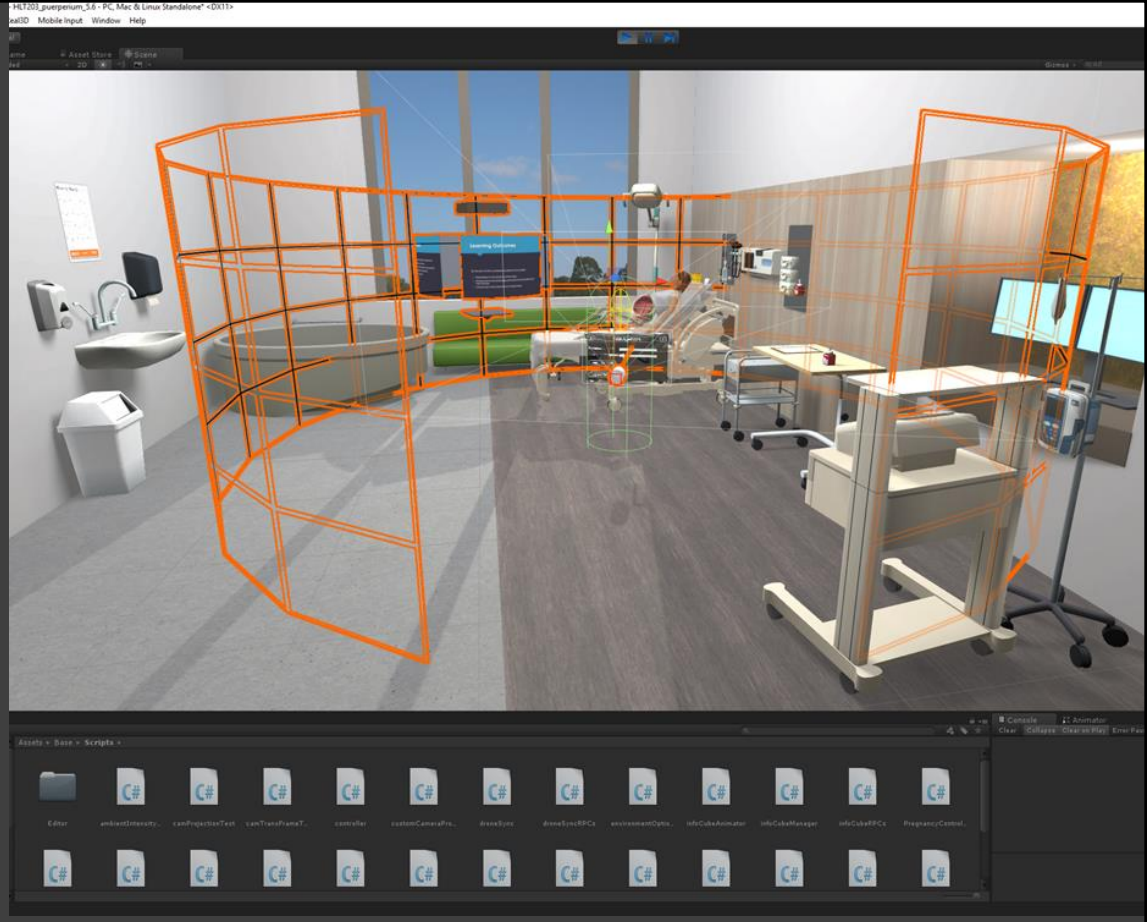


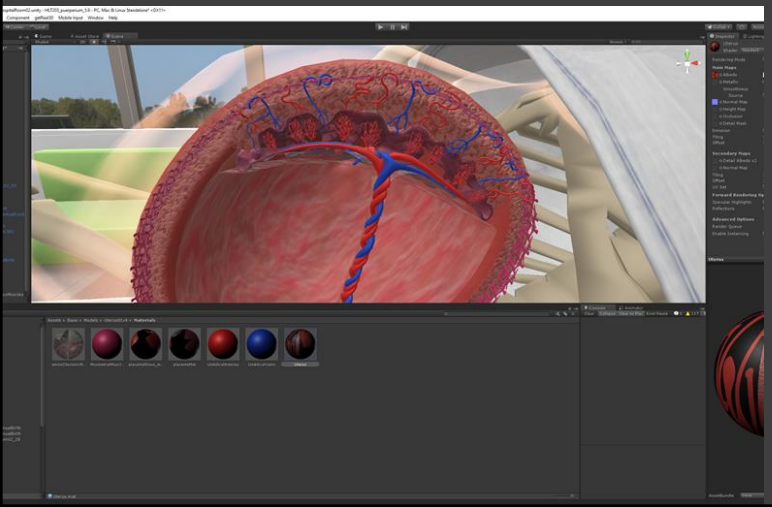
Development of the placenta and blood vessels
and the adaptation of an avatar into a pregnant state

Placenta : Rigging and Animation

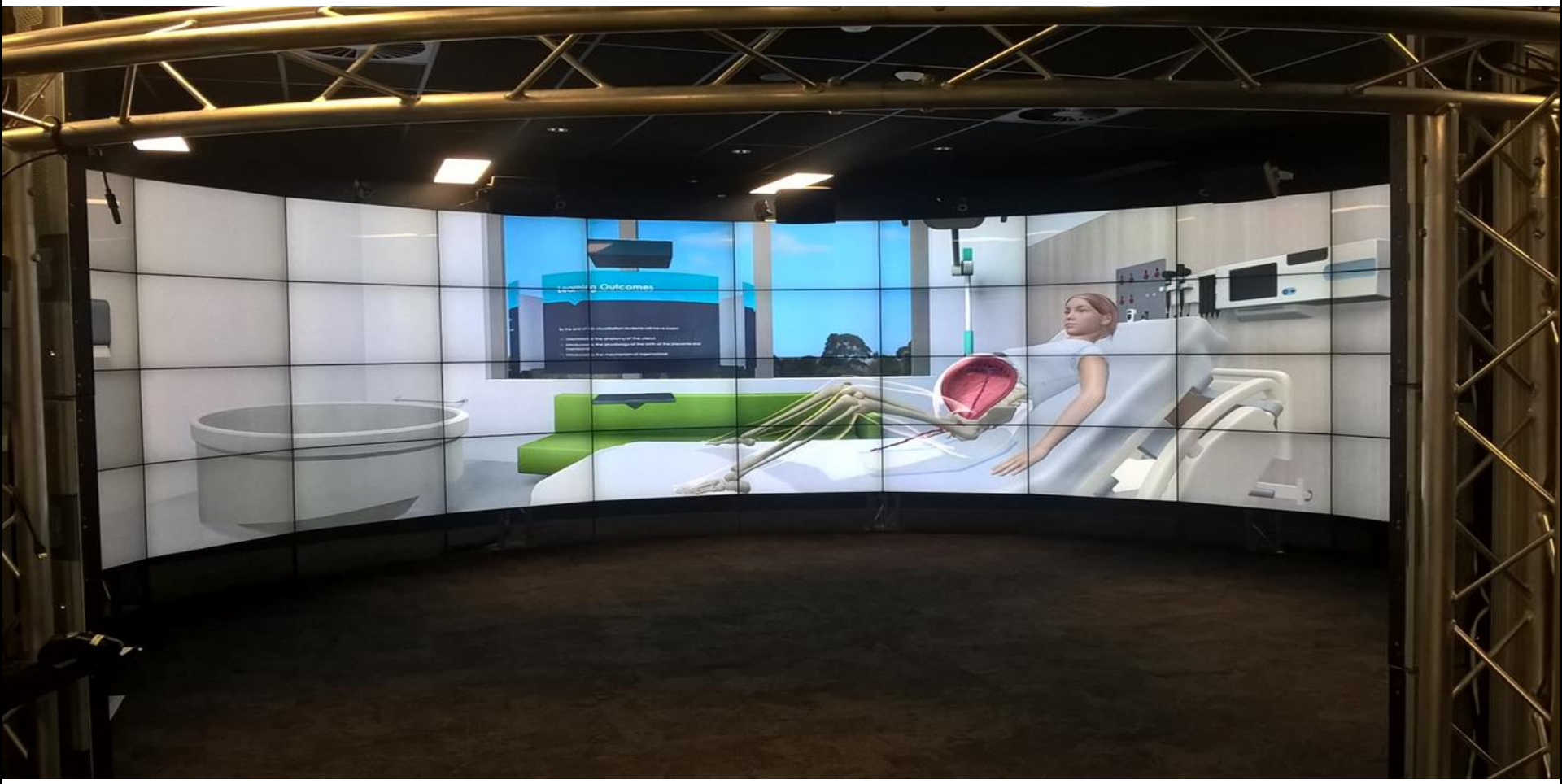


Showing this in five screenshots is like saying “once, we went to the moon”





Arranging Everything Together



Cave Automatic Virtual Environment (CAVE)

https://www.youtube.com/watch?v=_pDW4rcRFsE

USC AUSTRALIA

Student Satisfaction with 3DMVR Survey (2018)

- 14 second year midwifery students
- Positive feedback on the look of the graphics – the woman the 3D animation, the speed etc.
- Greater depth of understanding about the anatomy and physiology of the uterus and birth of the placenta.
- Reinforced traditional readings

Student's free text comments:

- *The 3D learning gives you a greater understanding through visual representation on how the birthing of the placenta works in stages*
- *It was helpful to watch the physiology moving and happening in front of me rather than reading about it and trying to imagine.*
- *More interactive kept me focused and engaged*
- *It was definitely a helpful, visual guide to what happens on the inside I think it reinforced the readings.*
- *I found it a lot more engaging, and I feel I learn more this way.*

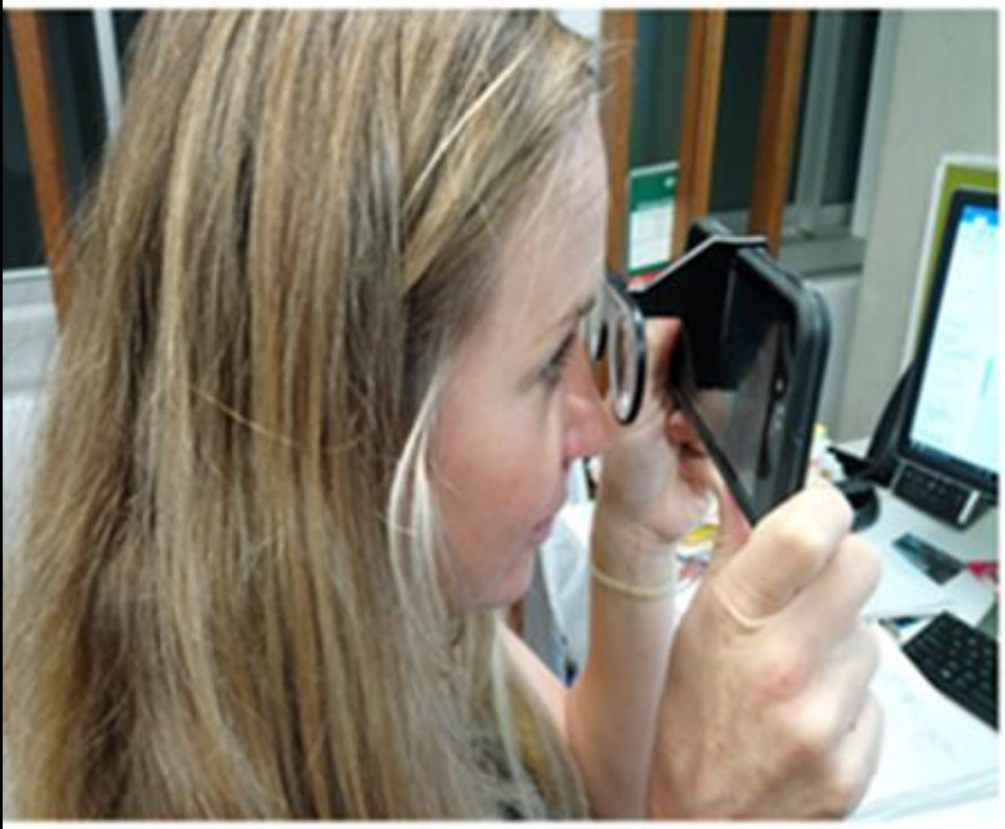
Dissemination of this innovation:

Publication

- Downer, T., Gray, M., Andersen, P. (2020). Three-Dimensional Technology: Evaluating the use of visualization in midwifery education. Clinical Simulation in Nursing, Volume 39, February 2020, 27-32.

Conferences

- Downer, T & Gray, M 2019. "3D technology a new pedagogical approach in midwifery education"8th International Clinical Skills Conference. Prato, Italy. 19 - 22 May, 2019.
- Gray, M. 2018 'A New Novel Approach to Midwifery Education' Australian College of Midwives (ACM) 2018 "Coming of Age" 21st National Conference. Perth, WA. 15 to 18 October, 2018.
- Gray, M. '3D Technology: Innovative visual approach to Midwifery Education' Transforming Midwifery Practice Through Education conference. Gold Coast, Queensland. 20-21st September, 2018. Friday 21st
- Downer, T., Gray, M 2018. An Evaluation of 3D Visualisation Technology in Midwifery Education. Queensland University Educators Showcase (QUES) 28th September, 2018. University of the Sunshine Coast
- Michelle Gray, Simon Osborn, Christopher Anderson, David Dixon and Terri Downer. 2018. 'Midwifery Education Artefact – using 3D Technology' SIMGHOST Conference. University of the Sunshine Coast, Queensland. 27-29th June, 2018
- Terri Downer, Michelle Gray, Simon Osborn, Christopher Anderson, and David Dixon. 2018. 'Students responses to the introduction of 3D visualization technology in midwifery education' SIMGHOST Conference. University of the Sunshine Coast, Queensland. 27-29th June, 2018



Pilot Study: Mobile 3DMVR

Context
CDU
(2019-2020)

- Charles Darwin University, Northern Territory, Australia
- Funding received to modify the 3DMVR to a mobile format
- Two legal contracts (education/research) – Intellectual property belongs to USC
- Aim: Evaluate use of 3DMVR via a mobile phone and assess impact on learning and retention of knowledge after use of the 3DMVR.
- Ethical approval was granted by Charles Darwin University: H19086.
- Participants: Second year Bachelor of Midwifery students during a pre-clinical teaching block.
- Recruitment: All second-year midwifery students (n=80) at were invited to participate in the study.
  - A sample size of approximately 35 students in each arm was speculated to have more than 80% power to detect at least 10% score difference between intervention and control group

Research Questions

1. What are the differences, if any, in knowledge acquisition (evidenced by MCQ scores), satisfaction ratings and self-assessed comfort scores of students exposed to the 3D midwifery visualisation resource (3DMVR)?

2. What are the differences, if any, in student test scores between students exposed to a) Traditional teaching only, and b) Traditional teaching followed by 3DMVR?

3. What are the differences, if any, in student MCQ scores at one-month post activity between students exposed to

   a) Traditional teaching only, and

   b) Traditional teaching followed by 3DMVR?

Research Methodology

- **Randomisation**
  - Students were randomised into the control or the intervention group using a computer-generated randomisation table
  - Intervention (n=20) or control (n=18) group
    - Of the expected 80 students enrolled, 41 attended due to covid 19 and 38 students consented to participate

- **Data Collection Tools**:
  - Demographic Survey – no differences between the groups
  - Multiple Choice Questionnaire (30 Qs) three time points
  - Student Satisfaction with 3DMVR Survey (Likert scale)

Data Collection Procedure – Two phases

Phase 1: Pre and post MCQs

Phase 2: Follow up one month later

Data analysis

- Descriptive and chi squared analysis of the demographics
- Multi-level model controlling for clustering effects for the MCQ.
- Stata 16 used for the student satisfaction surveys.

MCQ knowledge scores at three time points between the intervention (3DMVR) and control groups

	Control (Mean±SE)	Intervention (Mean±SE)	p-value
Baseline	18.6±0.6	17.8±0.6	0.353
Post-randomisation	18.5±0.7	22.3±.0.7	<0.001
One month later	19.1±1.0	20.8±1.0	0.241

$p < 0.05$ is significant

Q#	**Student Satisfaction of 3DMVR Survey** Questions	Likert Scale: Strongly Disagree – Strongly Agree				
		Strongly disagree	Disagree	Unsure	Agree	Strongly agree
1	I found the instructions for using the 3DMVR simple and easy to follow.			8%	75%	17%
3	I needed assistance to activate the 3DMVR	8%	25%		42%	25%
4	The 3D glasses fitted my phone and worked well.	8%	42%		33%	17%
5	The audio worked well.				50%	50%
6	I found the use of 3D technology made me feel nauseated.	17%	33%	17%	25%	8%
7	I remained seated while I watched the 3DMVR.	17%	8%		25%	50%
8	The 3DMVR enabled me to view the process of a physiological third stage of labour.				67%	33%
9	The 3DMVR helped me apply what I read in the pre-readings to the physiological events.			25%	42%	33%
10	The 3DMVR helped me conceptualise the 2D diagrams from the textbooks.			8%	67%	25%
14	The 3DMVR increased my knowledge and understanding of the physiological process regarding separation of the placenta and membranes from the decidua.			8%	33%	59%
15	My understanding of haemostasis and the contraction of the myometrial muscles of the uterine blood vessels is improved after watching the 3DMVR.			17%	50%	33%
16	The 3DMVR narration helped me understand where complications could occur in the physiological process.				42%	58%
17	The 3DMVR was a valuable learning experience.		8%		42%	50%

Recommendations

- Students like 3D visualisation as a teaching resource and want more similar resources. Therefore, we recommend further development of resources that help students understand complex concepts in midwifery education.
- Retention of knowledge is improved by visual animation and narration therefore academics should aim to include 3D visualisation within their teaching resources.
- Staff and students need support and early instruction on the use of new technologies used in learning.
- Research is needed to study how student's practice benefits from learning through 3D technology.

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