Final report

Virtual reality stunning training tool

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Abstract

The *virtual reality stunning training tool* project was commissioned by the Livestock Export RD&E Program to evaluate the impact of using virtual reality (VR) technology to provide stunning training to slaughtermen in destination markets of Australian livestock.

The aim of the project was to create a highly engaging, practical, realistic and targeted cattle VR stunning training resource, test its practical deployment and the training results of slaughtermen in market, and determine if it would deliver effective and consistent stunning outcomes amongst trainees.

Initial development included engagement with key industry stakeholders to design and build a highly realistic cattle stunning environment incorporating an interactive cattle crush, stunning tools and cattle. Several versions of the training environment and interactive simulations were provided for testing, with amendments subsequently made based on stakeholder feedback.

Field work was conducted with 30 trainee slaughtermen in Vietnam and Indonesia. Each trainee was taken through a training and evaluation sequence within VR covering briefing, practice and testing. After completing the briefing and practice sessions, each trainee had to stun five virtual cattle. Each stun "session" was evaluated against specific criteria of distance from optimal stunning point and angle of stunning tool.

Results from the field work showed improvement in stunning accuracy over just five sessions, with average accuracy increasing slightly and time to stun declining significantly. It is expected that these results would improve further with more structured integration of the VR tool into existing training approaches.

The research suggests that VR can provide effective and consistent stunning training which results in improved outcomes for slaughtermen and ultimately animals. It is recommended that the tool be integrated into existing curriculum and training programs as a practical component. It is then recommended that the tool be deployed with existing service providers and that ongoing data capture occur to further validate the tool effectively and guide further development.

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1. Background

The Australian livestock export industry faces ever increasing is required to meet regulatory requirements to ensure that the welfare of livestock is provided fort throughout the export and slaughter process. Community sentiment research indicates that the Australian community have high expectations that industry ensures the welfare of animals throughout the supply chain, especially while in transit and when in destination markets.

Livestock exporters are committed to ensuring high standards of animal welfare through the process, and animal welfare training and compliance programs are key to meeting the challenges that have been raised. Livestock handling and stunning training were identified as two areas in which to explore the potential for VR training to improve and sustain good animal welfare practices in key export markets such as Indonesia and Vietnam.

VR is seen as a potential contributor to any solution as it:

1. enables current and future slaughtermen to learn the task in a controlled environment, allowing mistakes to be made without any negative animal welfare implications

2. allows the trainee to practice as many times as needed without any harm to animals

3. provides data on the skill level of trainees before being given access to live animals

4. gives the trainee skills and confidence in the task prior to transitioning to live animals.

2. Objectives

The aim of the project was to research the potential of VR technology for use in livestock stunning training to deliver and support better animal welfare outcomes in destination markets. Specifically, the trials assessed the effectiveness of training (and benchmarking) local slaughtermen with VR tools to deliver consistently better slaughter outcomes, with a view to minimise negative animal welfare outcomes.

The key objectives of the project were:

- to create a highly engaging, practical, realistic and targeted cattle stunning training resource for in-market personnel

- research, test and report on the effectiveness of the virtual reality training versus current training methods through measuring the degree of change in outcomes (i.e. errors and accuracy) in the process of stunning cattle overseas

- capture potential improvements to enhance the effectiveness of the training in the future.

3. Methodology

The project followed three key phases:

3.1. Design of training environment

Virtually There, in partnership with LiveCorp, worked with key industry stakeholders to design a highly realistic cattle stunning environment incorporating an interactive cattle crush, stunning tools and cattle. The design phase included mapping out the tasks to be executed and alternative cattle behaviours to ensure the simulation was accurate and realistic, as well as reviewing industry livestock training resources. Following this, Virtually There provided the RD&E Program with design drawings and captured any feedback. This was to ensure the environment and task within the VR was engaging, practical and accurately portrayed in-market abattoir environments, conditions and specifications. There was also consideration to other industries and their use of VR for the purpose of training staff, and whether there were any learnings to be used for this project.

3.2. Build and test

Based on the design elements created in phase one, the team built the training environment and interactive simulations. Several versions were provided to key stakeholders for testing and review through this phase, with amendments subsequently made to the simulation based on feedback. There are five rounds of stunning, each consisting of five steps:

Step 1: Prepare

- check there are two stunners

- load cartridges into both stunners - one type was used to show the action and make it familiar. The loading action involved pulling the stunner into two pieces and placing a cartridge in the correct way, then snapping back together. This action was simplified for ease of use.

- reload spent stunner with additional rounds

Step 2: Apply neck restraint

- operator pushes the lever to engage

- the cow enters and the race gate closes automatically

- randomised slight variations in cattle size and colouring

Step 3: Prepare to stun

- pick up and cock handle

Step 4: Stun the animal

- place stunner in the correct position on the animal's head

- fire the stunner

- animal will drop and stay down if stunned correctly

- animal will drop and stand up again if not stunned correctly (incorrect stun will be randomised and happen a low percentage of times)

- operator to re-stun, if necessary, with second stunner

- if the operator fires a stun incorrectly (outside of the main target etc), the cow will react (head shake, stumble) but recover quickly

Step 5: Release

- pull the lever to release neck restraint

- this action marks the end of that round

- the side door opens, releases the animal and closes again. This is animated and happens automatically.
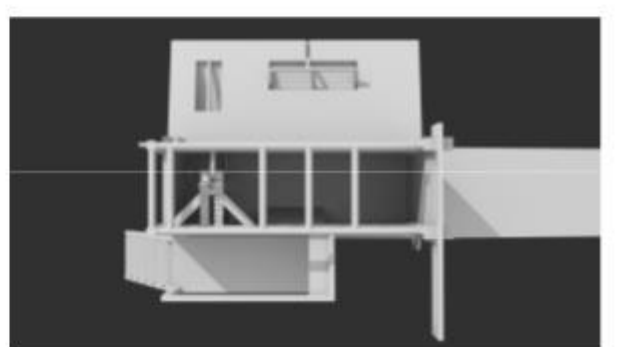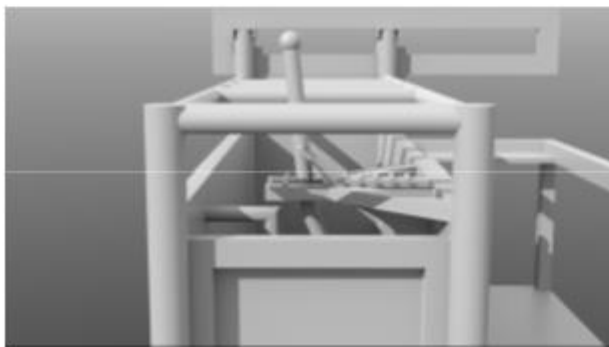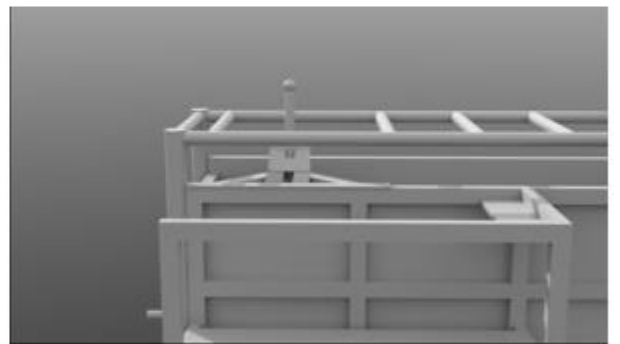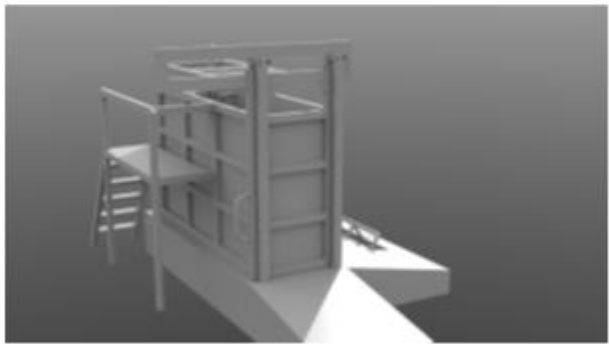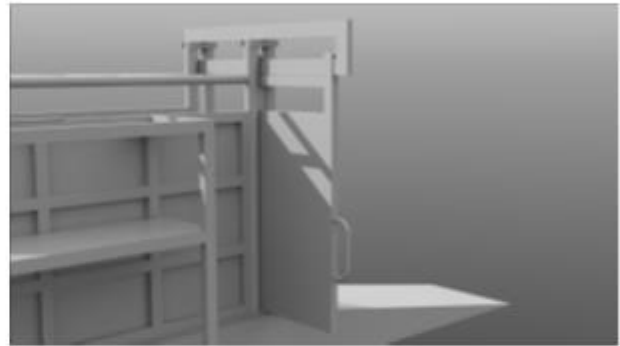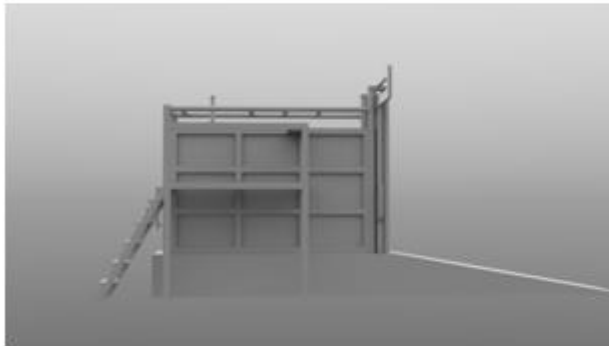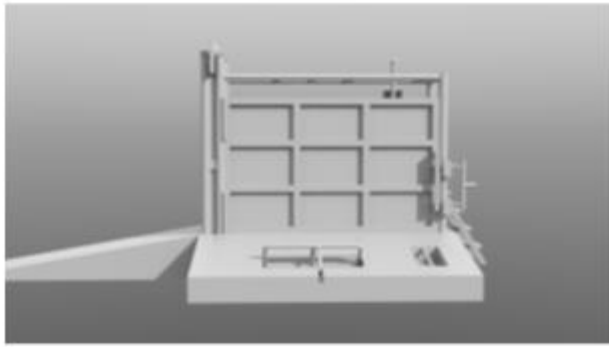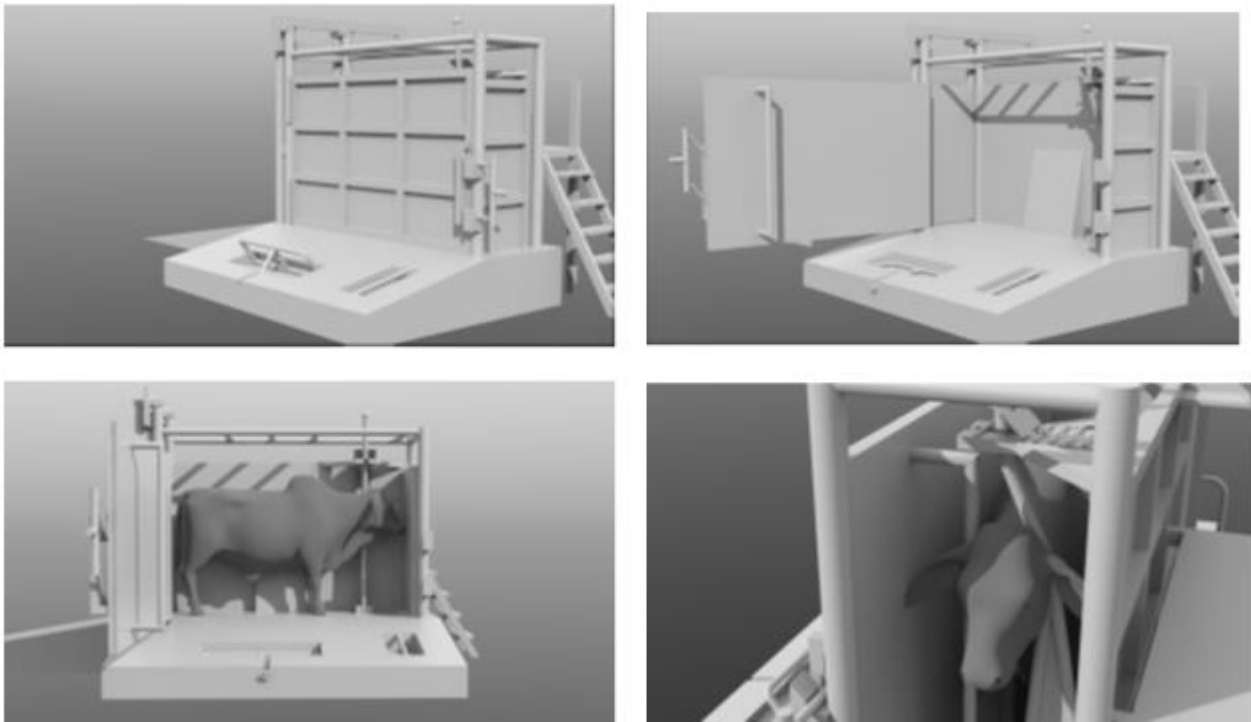
Design images of the stunning environment

3.3. Execute in-field research

Working with CooleCo, one of the RD&E Program's training providers, VR training was run with slaughtermen in Indonesia and Vietnam. The research was completed with a total of 30 trainees and incorporated two key elements:

3.3.1. Immersive training using the VR tool

Trainees were led through the three stages of training structured within the headset - briefing, practice, and evaluation. The briefing phase takes the trainees through an explanation of each step in preparation to execute the stun. This was followed by a practice session, where the trainees follow the process and execute a stun. Finally, the evaluation process requires the trainees to stun five cattle from memory without any guidance on what to do. The trainee was scored on each animal stunned based on the sequence followed in preparing and executing the stun, the proximity of the stun to the optimal stunning point and the angle of the stunning tool against the animal's head. Each trainee completed a total of 5 stuns, also referred to as sessions.

3.3.2. Questionnaire

Each trainee was then asked to complete a questionnaire around their experience with the VR training.

4. Results

During data analysis, the scores from five trainees were removed as part of the data cleaning process. Therefore, the results will discuss the scores from 25 trainees. Data from the VR simulations show that average stunning scores improved moderately over just five sessions, with average scores for the total group increasing from 80% in Session 1 to 83% in Session 5. Of key importance was the fact that the average minimum score for the group improved strongly from 73% in session 1 to 77% in Session 5.
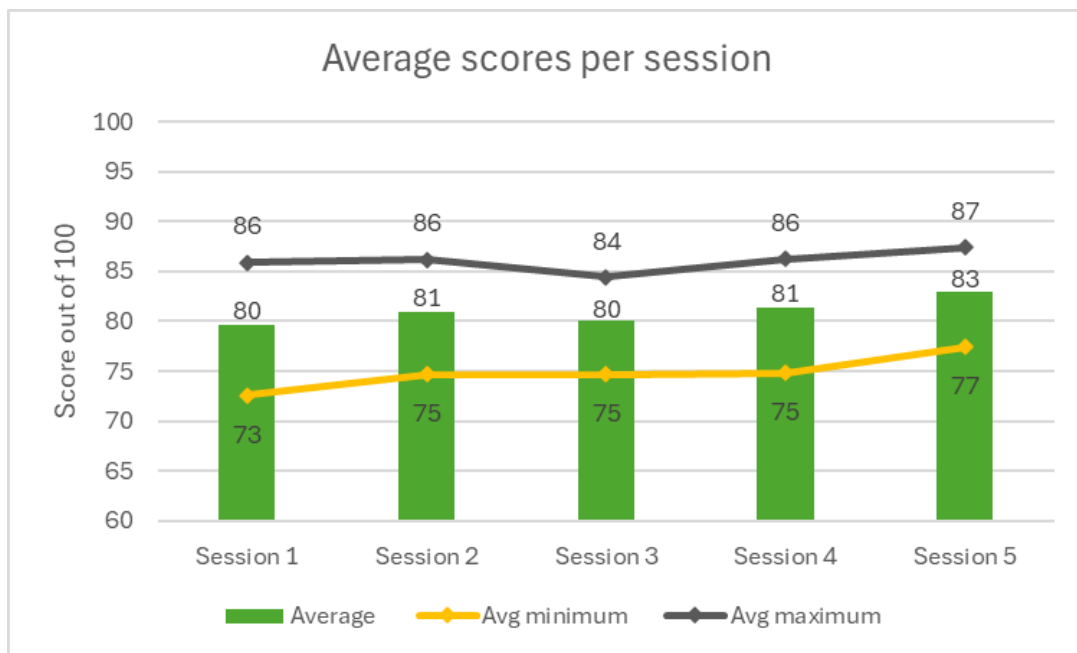
FIGURE 1. **Average stunning scores by trainees**

In addition, while the average rate of accuracy improved moderately, the average time to stun improved significantly from 65 seconds per stun to 47 seconds. This balance between time and accuracy should be explored further to determine how better outcomes could be achieved.
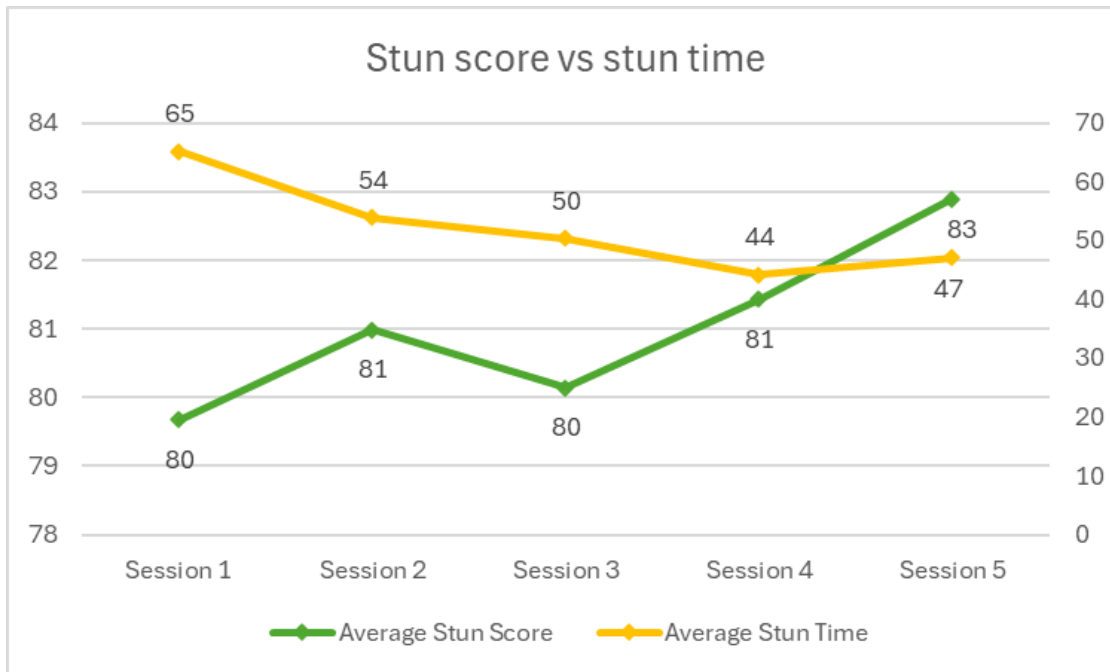
FIGURE 2. Average rate of accuracy amongst trainees over five sessions

From the dataset of 25 trainees, 68% saw an increase in their average stun scores between Session 1 and Session 5. This suggests that VR can have a positive impact on training outcomes for slaughtermen in a short time. While 32% of trainees did not see an improvement, the research shows that the VR tool can provide visibility and data-based feedback for trainers to use with these trainees in future training sessions.

TABLE 1. Improvement in VR training stun score by trainee over five sessions.

PARTICIPANT	SESSION 1	SESSION 5	CHANGE
P001	74	82	8
P002	75	81	6
P003	81	87	6
P004	61	85	25
P006	84	79	-4
P008	89	88	-1
P010	81	86	5
P011	75	78	3
P012	83	84	1
P013	79	85	6
P014	78	80	2
P015	85	81	-4
P016	73	86	13
P017	75	88	12
P018	83	90	7
P019	77	83	6
P021	86	81	-5
P022	77	82	5
P023	80	74	-5
P024	83	79	-4
P025	91	91	0
P026	69	77	8
P027	90	78	-12
P028	78	75	-3
P029	85	90	5

Results from the questionnaire following the training indicate that a significant number of trainees found the simulation effective, engaging and realistic. However, better on-boarding is required to improve user experience and subsequently confidence to use the VR platform. Within the trainee group there was a wide range of starting capability for using the VR equipment. Some trainees had previous experience with VR controllers and were able to easily adapt and quickly commence the training, whereas some trainees spent a longer amount of time learning to control the device prior to commencing the training. Most users who found the training most challenging (Fig. 3) were also those who were least familiar with use of VR systems.
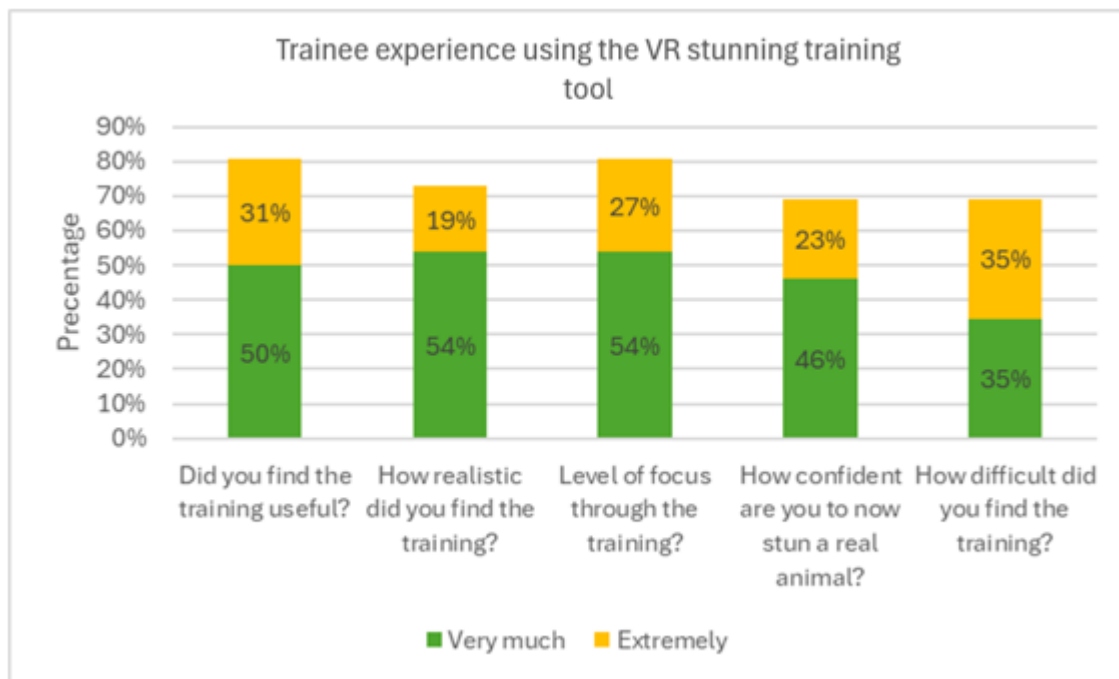

FIGURE 3. Overall trainee experience using the VR stunning training tool

5. Conclusion

The research suggests that VR training can assist in improving stunning outcomes amongst slaughtermen in destination markets for exported Australian livestock. Further improvements in scores may be seen with the structured integration and time allocation of VR within existing formal training events so that it is part of a holistic approach to training rather than a standalone component. Based on the results, we conclude that VR can support LiveCorp, MLA and livestock exporters to deploy practical training consistently and cost effectively across different geographies. More effective stuns and better animal welfare outcomes would assist industry in delivering its commitments to sustainable livestock exports.

Consultant from CooleCo giving training instructions to Dr Supratikno from IPB University Bogor

5.1. Key findings

While average accuracy rates improved moderately, minimum scores improved significantly, suggesting improved stunning results and better animal welfare outcomes when translated into the real world. Results from the questionnaire following the training indicate that a significant number of trainees found the simulation effective, engaging and realistic.

5.2. Benefits to industry

This realistic, practical training, in a safe environment would allow trainees to build the capability and confidence before they execute a stun in the real world, improving the likelihood of effective stuns and better animal welfare outcomes for live cattle shipped to markets. The focus on following the correct process to prepare for, apply and monitor signs of an effective stun without the use of live animals will allow industry to mitigate some of the risks associated with live animal training.

6. Future research and recommendations

- It is recommended that the VR training tool be deployed with MLA and LiveCorp's approved training partners in a structured way within the current training curriculum and programs. This would enable adequate time and context to be provided to trainees when using VR, potentially yielding better results. Trainees should first be assessed for their starting familiarity with VR systems and sufficient time allocated to allow them to adapt to using the system controls prior to commencing the scored training stages.
- It would be beneficial to ensure that trainers themselves have undertaken sufficient instruction in how to best deploy the tool to ensure effective training. VR training is a new and novel method for delivering animal welfare training and is most effective when trainers are given time to familiarise themselves with the equipment and the unique training delivery method.
- Further data capture and analysis should be undertaken to see how average performance improves and how the simulation can be further optimised. Of particular interest would be the change in average performance scores for trainees tested across a broader time duration, such as repeat training sessions several months or years apart.

Trainee trialling VR stunning training tool at Vietnam training day