Integration of virtual reality technology into the curriculum of forensic science courses using crime scene investigations

Raul Sutton[1]
Matthew Hammerton [1]
Keith Trueman [2]

[1] School of Applied Sciences
[2] West Midlands Police

Introduction

Virtual reality technology is a powerful tool for the development of experimental learning in practical situations. Creation of software packages with some element of virtual learning allows educators to broaden the available experience of students beyond the scope that a standard curriculum provides. This teaching technology is widely used in the delivery of medical education with many surgical techniques being practised via virtual reality technologies (see Engum *et al.*, 2003). It has a wide range of teaching applications such as virtual field trials for an environmental science course (Ramasundaram *et al.*, 2005), and community nursing visiting education scenarios (Nelson *et al.*, 2005). Nelson *et al.* (2005) imaged three-dimensional representations of patient living accommodation incorporating views of patient medication in order to deliver care modules via a problem-based learning approach.

The use of virtual reality in the teaching of crime scene science was pioneered by the National Institute of Forensic Science in Australia as part of their Science Proficiency Advisory Committee testing programme. A number of scenarios were created using CD-ROM interfacing, allowing, as near as possible, normal procedures to be adopted. This package included proficiency testing integrated into the package and serves as a paradigm for the creation of virtual reality crime scene scenarios (Horswell, 2000). The package is commercially available on CD-ROM as part of the series 'After the Fact' (http://www.nfis.com.au).

The CD-ROM package is geared to proficiency training of serving Scenes of Crime Officers (SOCO) and thus contains details that may not be needed in the education of other parties with a need for forensic awareness. These include undergraduate students studying towards forensic science degree programmes in the UK as well as serving Police Officers. These groups may need virtual reality crime scene material geared to their specific knowledge requirements. Professor J Fraser, President of the Forensic Science Society and a former police Scientific Support Manager speaking to the United Kingdom, House of Commons Science and Technology Select Committee stated in its report 'Forensic Science on Trial (2005):

> 'The documented evidence in relation to police knowledge of forensic science, in terms of making the best use of forensic science, is consistently clear, that their knowledge needs to improve and therefore their training needs to improve'

This clearly identifies a need for further training of serving police officers in forensic science.

It was with this in mind that staff at the University collaborated with the West Midlands Police Service. The aim was to create a virtual reality CD-ROM that could serve as part of the continuing professional development of serving police officers in the area of scene management. Adaptation of the CD-ROM could allow some introductory materials to help undergraduate students of forensic science.

Innovation

Crime scene investigation learning objectives were developed to be appropriate for our target audience. Topics included:

- Issues of health and safety at crime scenes
- Securing the crime scene
- Common approach paths in crime scene examination
- Protecting labile evidence
- Dealing with witnesses
- Continuity and integrity in evidence handling
- Evidential value of trace and contact evidence.

The delivery vehicle chosen for the police clientele was via CD-ROM avoiding many of the problems associated with web-based delivery in restricted access sites. The student audience would view the final product using a web-based interface, which meant that the length of individual video clips were kept as small as possible.

Production of the CD commenced by looking at various ways of storyboarding a crime scene scenario. An appropriate storyboard and script was conceived, for production at the West Midlands Police (WMP) Crime Scene Training Facility. The Training Facility allowed the collection of video and images. Part of the scenario developed involved members of the WMP who were able to 'act' as Police Officers and victims. The use of serving Police Officers gave credibility to the scenario when viewed both by other serving officers and undergraduate students.

Video clips were used to introduce the viewer to the crime scene and guide them around the area. The images were used to provide close up views of all the possible evidence as well as displaying the main crime scene area as a partial panorama. Again size and number of images were key considerations due to their effect on the final file size.

The team members' individual expertise was combined to produce a series of questions with formative feedback responses that would test the viewers' knowledge in Crime Scene Investigations. The questions were scored so that the viewers' obtained an overall score and 'feedforward information' (Gibbs & Simpson, 2005) at the end of the resource allowing them to assess and improve their knowledge where necessary.

The media, text and questions were combined seamlessly using Macromedia Flash™. The program allowed the team to stream the relevant content only, giving the viewer quicker access to the resource. The program also allowed the team to control the viewers' movements in order to guide them through the resource (Hammerton, 2005).

Results and Discussion

Undergraduate students

The software was trialled with undergraduate students as a web accessible package linked to a second level module introducing students to crime scene investigation. The package was accessed during formal teaching time as part of the formative assessment for the module and allowed the students to consider issues relating to material that would be later tested by means of a formal examination.

Integration of the software into a web-based format allowed the estimation of time taken to complete the tutorial as well as the overall score gained by the students. The null hypothesis tested here was that: H_0 there is no relationship between time taken to complete the tutorial and the score gained by the students.

This was tested using product-moment correlation coefficient where a score can vary between ± 1.0 to indicate positive or negative correlation. A score near to zero indicates no correlation between the two variables. The results of this test gave a value of -0.53 for the product-moment correlation coefficient indicating that there was some negative correlation with time taken to complete the test

and the score gained. This result is surprising and may indicate that students who had prepared for the tutorial and knew the expected response were able to progress much more quickly to successful completion of the tutorial. The average time taken to complete the tutorial was 12 minutes with an average score of 70%. This may indicate that the questions were not searching enough for this client-base.

The students were asked to reflect on the learning experience by means of a guided questionnaire designed as a five point Lickert scale with a section for students to enter free response comments. The evaluation questions are shown below:

1. The instructions given on the first page were clear and easy to follow
2. The quality of the images is sufficient for accurate deduction
3. The information was logically presented
4. The quality of the graphics made the exercise interesting
5. The interaction that was required made the exercise interesting
6. The exercise was difficult to follow
7. This type of exercise should be used more often to support mock crime scene investigations
8. This type of exercise should be used to replace mock crime scene investigations
9. Working through the exercise really made me think
10. I learnt more from doing this type of exercise than studying course material
11. The exercise was not very challenging
12. The feedback in the exercise helped me understand things better
13. The feedback in the exercise showed me how to do better next time
14. I don't understand some of the feedback in the exercise
15. I would recommend this exercise to other students.

The results showed that there was strong agreement with questions 1-5, 7, 9, 13, and 15, agreement with question 12, not sure about questions 10 -11 and disagreement with questions 6, 8, and 14. The conclusions that could be drawn from these responses were that the software package was well constructed and easy to follow, that the students would like to see more of these as support of crime scene investigations but would not see them as an alternative to crime scene investigation practicals. The students also felt that they were made to think. Free comments supported these observations with their overall assessments described as:

• 'Well thought out, exciting, logical and interesting!'

• 'Good program, interesting, complements the lectures well, informative, would be good for other forensic modules to include programs like this.'

• 'A very entertaining exercise. Would be better if more challenging and interactive.'

Further development of this software may need to include extension exercises for the more able student.

The Police Force

Preliminary trials of the CD-ROM were circulated to one operational command unit for serving officers to evaluate. The responses were not formally assessed via questionnaire but informal feedback was given. The response from this was favourable and the software was demonstrated to a group of interested parties from Centrex (The Centre of Excellence for Police Training) and the Forensic Science service with a view to expanding this arm of the project's remit. The response from this was favourable and compared well with previous products designed by the Forensic Science Service for police forces with evidence preservation in mind. However, the way in which police continuing professional development was being managed changed with all training materials needing to be subjected to a validation audit by training authorities within the force. This process is still underway at present and the outcome of this will determine the future use of the package within the Police Services of England and Wales.

Overall Summary and Future Developments

The creation of high quality software materials using Macromedia Flash has been successfully carried out at the University. The software has been well received by both client bases and is being used as a teaching resource at the University. Demonstration of the software at a learning and teaching conference (Sutton, 2004) has led to an invitation to staff from within the West Midlands Police Service and the University to co-author a text around crime scene investigation utilising some of the techniques successfully piloted in this project.

The software will be developed as a vehicle for final year undergraduate student projects. This will increase the range and scope of simulations that are offered to students at the University.

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