

Advancing Police Training Through Virtual Simulation: Lessons from Dubai Police

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ABSTRACT

Dubai Police has pioneered the integration of cutting-edge video game technologies to create immersive virtual training environments for law enforcement. These simulations replicate real-world scenarios, including crime scene investigations, traffic accident reconstructions, and hostage situations requiring SWAT planning and intervention. By utilizing a learn-by-doing approach, these interactive training solutions allow officers to develop critical decision-making skills in a risk-free and engaging environment, bridging the gap between theoretical learning and real-world application.

Recognizing the limitations of traditional training methods, Dubai Police invested in extensive research and development to innovate and enhance law enforcement education. Over the years, the organization has built a comprehensive portfolio of virtual training products, leveraging game engines, virtual reality (VR), and artificial intelligence (AI) to provide realistic and adaptable learning experiences. These solutions have contributed to a significant technological transformation in police training, ensuring officers are better prepared for real-life challenges.

All virtual training applications have been developed in-house by the Virtual Technology Centre, a specialized unit within Dubai Police. This initiative aligns with Dubai Police's four strategic goals, focusing on enhancing security, operational efficiency, community engagement, and law enforcement excellence. The success of these products has led to their adoption and recommendation at national, regional, and international levels, including collaborations with the United Nations and the International Civil Aviation Organization.

This paper presents an in-depth analysis of Dubai Police's virtual training initiatives, highlighting their effectiveness, challenges, and long-term impact. Using Kirkpatrick's evaluation model, we examine how these simulations improve knowledge retention, decision-making, and operational performance. Additionally, we discuss the scalability of virtual training for other law enforcement agencies worldwide, providing key insights for future advancements in police training through simulation-based learning.

ABOUT THE AUTHORS

Dr. Mansoor Alrazooqi is the Director of the Virtual Technology Center at Dubai Police. With over 15 years of experience in the training and simulation industry, he has led a wide range of national projects that integrate immersive technologies into public safety, law enforcement, and community awareness. His work spans information technology, systems architecture, and applications development, with a focus on serious games and gamified learning environments. Dr. Alrazooqi has overseen the development of multiple award-winning simulation platforms and educational games, contributing significantly to innovation in police training, public education, and digital transformation

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INTRODUCTION

Dubai Police has employed cutting-edge video game technologies to create virtual incidents ranging from crime scenes to traffic accidents to hostage scenarios that require SWAT planning and intervention in an engaging way that mimics real-life situations to allow the trainee to learn by doing to harness their skills in a safe and practical environment. Dubai Police realized early on the need for solutions to enhance and support the traditional methods employed for learning and awareness. Over many years, it has researched and developed many virtual environment prototypes with a large portfolio of virtual environment products to reach the current state. These products have been replicated in many different fields and are shaping a technological transformation for the methods used in learning and awareness in the Police domain and beyond.

The technological development in general and the evolution of video game technologies and applications in particular led to a noticeable gap between two generations, a generation that grew up with technology and is called the generation of "digital natives" and a generation that grew before the advent of technology and is called the generation of "digital immigrants". Each generation has its own characteristics and its favourite ways of learning. Prensky (Prensky, 2001) said that digital natives who are born after 1974. He summarizes the differences between them and digital immigrants (as shown in Table 1). He also noted that the average college student spends less than 5,000 hours of their lives reading, compared with 10,000 hours spent on video games and 20,000 hours watching television. This surge in game utilization is a disruptive technology since it challenges the existing expertise and practice, requires new skill sets, and demands organizational change (Lenoir, 2003). The change in the characteristics of the digital natives is evidence of this disruption, which has increased the pressure on the dominant educational delivery mechanism: the lecture. The disruption also affects the teacher by changing the learning from teacher-centred to player-centered (Stapleton, 2005). This changes the role of the teacher when using games from being an agent transmitting knowledge to becoming a promoter who enables learning (Chwif & Barretto, 2003).

The use of serious games dates back to the 1980s when Battlezone was used for military training. However, the interest in serious games has only lately been accelerated by the increased interest shown by the U.S. Department of Defense (DOD) in video games technology (Keller-McNulty et al., 2006) and also initiatives with more than a military focus such as the Serious Games initiative, International Simulation & Gaming Association, North American Simulation, and Gaming Association. In the military domain, the technology was used to train different skills, such as rifle range and obstacle courses (Zyda, 2005), leadership, and tactical experience (Beal, 2004). It is also used in health domains such as therapy (Re-Mission, 2006; Stapleton, 2005) and training procedural skills (Hoffman, 2006; Russell, 2005). Moreover, serious games were used in teaching physics (Jenkins et al., 2003; Stapleton, 2005), mathematics (Elliott & Bruckman, 2002), and history (Jenkins et al., 2003).

The Police domain is still far behind in the use of virtual technology in training. Most of the examples found use video-based simulations, and there is a lack of empirical studies, as was shown by a report conducted by Bennell and Jones (Bennell & Jones, 2003). Despite an exhaustive search and two decades of video-based simulations, the report found that the documentation of their effectiveness was scarce. The report only managed to find four studies that used simulations for police training. This shortage can be explained by the high cost of using the video in training because it requires representation staff, photography staff, and others, and the difficulty of changing the scenario, which usually involves re-filming of the scene and there is no complete freedom for the trainee to explore what he wants due to limited scenes (Aldrich, 2004).

THE PROBLEM

Traditional training methodologies employed by Dubai are non-interactive learning (Passive learning), characterized by theoretical lectures and infrequent practical exercises, which demonstrate several critical limitations. Interactive learning depends on learning by doing and forcing the learner to employ several senses compared to passive learning, which depends on a single sensory channel (hearing) that assumes learners' perceptual and intellectual uniformity. The shortcomings of passive learning can be summarized in five points. The first point is that the ideal learning situation must be customized to the very specific needs of the learners, but in the case of lectures, it is a one-size-fits-all approach that ignores the individual's learning style. The second shortcoming is the lack of immediate feedback. The third is that it fails to allow active discovery and the development of new kinds of comprehension. The fourth is the lack of motivation, which undermines engagement. The final shortcoming is linked to its failure to ensure that the concepts and procedures are committed to long-term memory, which makes them available thereafter for the analysis and interpretation of real-world experiences. All of these factors have made it essential to search for more suitable learning methods that provide a safe and practical environment for the trainees.

The challenges facing the practical training using scenarios include the cost (cost of time and money) and the difficulty of implementation. On-the-job training in the workplace suffers from several challenges: impracticality, lack of a safe environment, the feeling of the trainee being embarrassed to make mistakes in front of the public and colleagues, and the difficulty of repetition. These challenges also apply to the criminal field if we are to train in crime scene investigation. For example, students who learn by doing have an average retention rate of 75% compared to an average retention rate of 5% for those who learn from lectures (Magennis & Farrell, 2005). Another study puts retention rate at: 90% from simultaneously seeing, hearing, and doing, 80% from doing, 40% from seeing, and 20% from hearing (Joyce, 2005).

The use of virtual reality technology has proved its ability to support the education and training process in various fields because of its characteristics, such as practical application. This enables them to attract and hold the attention of the trainee for long periods, which is an important factor in the connection and consolidation of information according to the theories of learning mentioned earlier. Therefore, it is important to explore the integration of virtual reality technology within Dubai Police's training programs, specifically focusing on investigation training. It aims to comprehensively evaluate the potential and effectiveness of VR as an educational tool, examining its capacity to bridge generational divides, improve educational outcomes, and significantly enhance practical investigative skills (Whitney, Temby & Stephens, 2013).

METHODOLOGY

A comprehensive mixed-method approach combining qualitative and quantitative methodologies was utilized to achieve a holistic evaluation of VR's effectiveness in Dubai Police training. The rationale for adopting a mixed-method approach lies in the complexity of evaluating educational technologies, particularly VR, which require both numerical performance metrics and qualitative insights into trainee experiences and perceptions (Chen & Michael, 2005).

The methodology was systematically organized into several distinct phases, ensuring rigorous data collection, analysis, and validation of findings. These phases include assessment and document analysis, stakeholder interviews, observational studies, comparative experimental design, data collection and analysis, and qualitative validation.

EXPERIMENT

To develop the first virtual training program, a field study was conducted to better understand the traffic investigation field. The field study was divided into two phases: knowledge acquisition and preliminary experimentation. The main objectives of the knowledge acquisition phase were to better understand the investigation process (Figure 1 below shows a typical traffic accident investigation (TAI) and to identify the instructional problems facing current training in the Dubai police force, which consists mainly of lectures and on-the-job training. The objective of the preliminary

experiment was to examine the suitability of using serious games to teach traffic investigation. The preliminary experiment compared the use of a multiplayer serious game against the use of tabletop training. The results helped in identifying what TAI must focus on and in getting a feel for the acceptance of such technology in the Dubai police force.



Figure 1: Typical Traffic Accident Investigation.

An experiment was conducted to measure the effectiveness of TAI as a training tool and to analyze its suitability to address the issues facing the Dubai police force. Fifty-six participants were selected randomly from traffic investigators in the Dubai police force (see Figure 2).



Figure 2: The Experimentation Part of The Field Study.

Analysing the performance in Table 1 (using the column headed `change`) shows that both trained groups (novices-B and experienced-B) have managed to improve their performances by 36.17 and 23.54, respectively. Feedback from both trainers and trainees indicated that virtual environments effectively address the limitations of traditional methods such as lectures and on-site training. Lectures often lack interactivity and practical context, while field training poses challenges in repetition, evaluation, and creating a safe, pressure-free learning space.

Table 1: Average Performance Score and Improvement

Group A (Control)	Pre-test			Post Test	Change
Beginners A	37.25	Without Training		39.07	1.82
Experienced A	49.33			47.34	-1.99
Group B (Training)	Pre-Test	Training Session 1	Training Session 2	Post Test	Change
Beginners B	40.04	30.97	76.11	76.21	36.17
Experienced B	51.86	36.01	67.38	75.4	23.54
<i>Average</i>	<i>45.95</i>	<i>33.49</i>	<i>71.75</i>	<i>75.81</i>	<i>29.86</i>
<i>Difference</i>	<i>11.82</i>	<i>5.04</i>	<i>8.73</i>	<i>0.81</i>	<i>12.63</i>

Virtual simulations provide an engaging and controlled environment that allows for error without real-world consequences, making them an ideal preparatory tool before real-life exercises (see Figure 3). Additionally, the technology enables detailed tracking of trainee behaviour, such as movement paths and time-stamped actions during traffic accident simulations. This data supports in-depth procedural analysis, facilitates knowledge transfer, and enhances continuous and remote learning through session recording and playback.

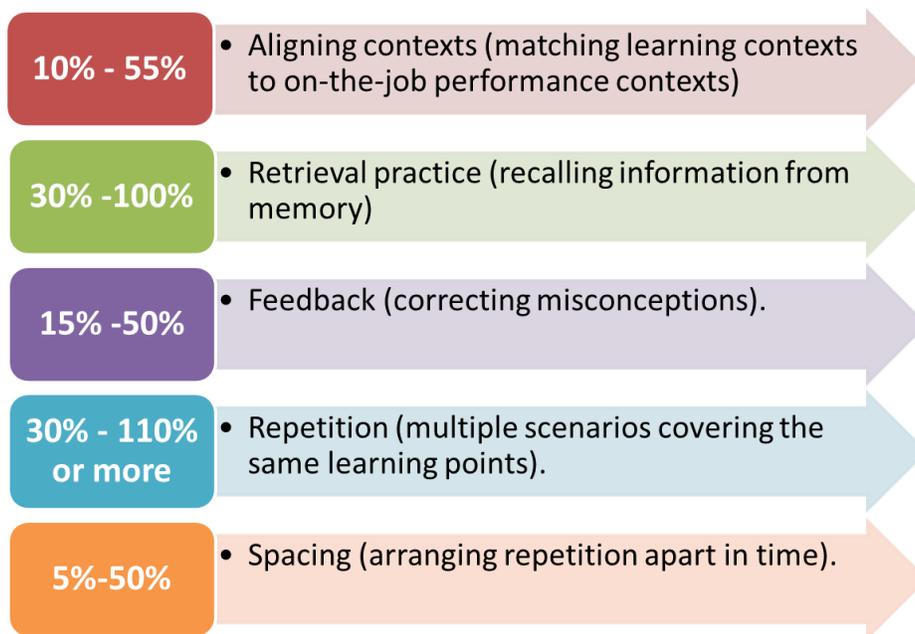


Figure 3: Strength of Games or Simulations.

Comments from participants who were trained with our serious games indicated that it was effective and its ability to teach. In addition, many found that it was excellent and useful. Comments from trainers showed that Serious Games effectively improved performance and provided an environment that they could utilize in a classroom setting.

Besides improving performance, other indications suggest the potential suitability of serious games to address the problems with the two training methods-lectures and on-the-job training-employed by the organization. The issues facing the use of lectures are: exam-focused teaching, lack of hands-on practice, class size and time constraint, and lack of motivation and engagement. The exam-focused teaching could be attributed to the fact that students are only tested using theoretical examinations, which leads them to focus on the topics that are going to be in the exams. These exams often measure the students' ability to memorize facts, but the students' ability to apply the knowledge remains questionable. Serious games can provide a platform for students to put what they have learned into practice, which can help them refocus on the whole investigation topic rather than what will be in the exam. Additionally, a game often forces students to take an active role, which provides hands-on practice.

The findings suggest that there is a statistically significant improvement in the performance of both novices and experienced investigators who were trained on TAI compared to those who were not. The results helped in identifying what TAI must focus on and in getting a feel for the acceptance of such technology in the Dubai police force. Therefore, TAI was developed in response to the needs and has learning objectives to provide an environment that resembles a real traffic accident investigation that is practical and varies in complexity.

IMPLEMENTATION

The implementation of the virtual training technology in Dubai Police started with TAI. The program is designed to train participants on how to handle various types of traffic accidents. It equips trainees with the skills needed to carry out investigation procedures such as attending to injured individuals, securing the accident scene, interviewing witnesses, taking measurements, and managing traffic flow. TAI includes a diverse set of realistic scenarios designed to simulate a wide range of accident types. These scenarios include a minor collision at an intersection, a pedestrian accident, a vehicle rollover, a major multi-vehicle crash, a collision between a truck and a taxi, a combined collision and rollover, and a traffic collision. Each scenario presents unique challenges to help trainees practice critical procedures such as securing the scene, assisting the injured, collecting evidence, and managing traffic flow effectively.

TAI is then replicated to other fields such as crime scenes, SWAT, body language, and many other fields. Our serious games (see figure 4) are available on PCs in the training halls, virtual fields using virtual glasses, provided to trainees on smart devices, and the Dubai Police App Store. These allow the trainees to have training at any time and at their convenience.



Figure 4: Virtual Application.

TRAINING EVALUATION

We use Kirkpatrick's model to evaluate training. Kirkpatrick's model consists of four levels: Reaction, Learning, Behaviour, and Results. Reaction measures the participant's satisfaction with the training program. Kirkpatrick notes that if their responses are not positive, they will not be motivated to learn. But if their responses are positive, It is not certain that they have benefited, but this increases learning opportunities only (O'Neill, Moore & McMullin, 2005). The learning level measures the extent of knowledge and skills development and is measured in the scope of the training session. The behaviour level is measured in the scope of work after completion of the training and measures the level of knowledge and skills transferred to the workplace. The results level measures training from the organization's perspective to see the return on investment in training. Results include increased productivity, improved quality of knowledge and performance, reduced cost, etc. We use Kirkpatrick's model as follows:

- Level 1 Reaction is evaluated through interviews and questionnaires, and it is a measure of customer satisfaction. We provide forms for the people to fill out at the end of a class or workshop, and this is used as an instrument for measuring Level 1.
- Level 2 Learning is evaluated through pre and post-tests, and this is used to measure learning and the increase in knowledge as a result of attending a program.
- Level 3 Behaviour is evaluated through Observations (transfer of knowledge, skills, and/or attitudes from training to on-the-job). This is used to measure the extent to which a change in behaviour has occurred as a result of attending a virtual training program
- Level 4 Results: Performance-based KPI (On-the-job evaluation using control groups). This involves measuring the final results that occurred as a result of attending a virtual training course

MEASURABLE BENEFITS

Tangible- Benefits & Results:

1. Our virtual training products cover all 4 strategic goals of Dubai Police and range across 10 different security & awareness topics, servicing most of the 20 general departments and all the police stations, and more than 7 other organizations.
2. The solution also has a good learning impact that has been proven in the classroom as well as in the field. For example, in the field of crime scene investigators, crime scene investigators who were trained using virtual environments performed better in real cases than those who weren't by an average of 57.2% (evaluated on 17 tasks on real crime cases). Moreover, for crime scene investigation, the performance of the group that trained using the Crime Scene Investigation virtual program increased by 32.8% (see Figure 3).



Figure 4: Passengers Screening Virtual Training.

Intangible- Benefits & Results:

1. Research capital in the Virtual Environments: In the process of building its portfolio and during the R&D phase, Dubai Police has managed to publish 15 publications in journals, conferences, and through other channels in different countries such as the UK, USA, Spain, France, Jordan & Belgium.
2. Human Resources capital: Since all the development is made in-house and thus Dubai Police has managed to build a strong team of experts in the virtual environments field.
3. Innovation capital: Dubai Police is viewed as a pioneer in the region as it houses the first specialized in-house games development center in a police organization, which focuses on developing serious games. Additionally, Dubai Police was the first police force in the world to build a simulation for traffic accident investigators.

Financial Benefit:

The cost analysis of training delivery clearly demonstrates the significant financial advantage of virtual training over traditional field-based methods. For instance, training 2,010 officers in crime scene investigation and traffic accident investigation through virtual platforms incurred a total cost of approximately 2.1 million AED, translating to around 1,045 AED per trainee. In contrast, delivering the same training through conventional field methods amounted to approximately 95.9 million AED, or nearly 47,712 AED per trainee. This results in a cost saving of approximately 93.7 million AED (equivalent to 25 million USD), representing a reduction of over 97% in training expenditure. These savings stem not only from reduced logistical costs—such as transport, physical site management, and instructor hours—but also from eliminating risks related to safety, damage to equipment, or public disruption. Moreover, virtual training enables unlimited scenario repetition and remote access, which further reduces opportunity costs associated with downtime and scheduling. The return on investment (ROI) is substantial and scalable, offering long-term financial sustainability while simultaneously enhancing training efficiency and accessibility across the police force.

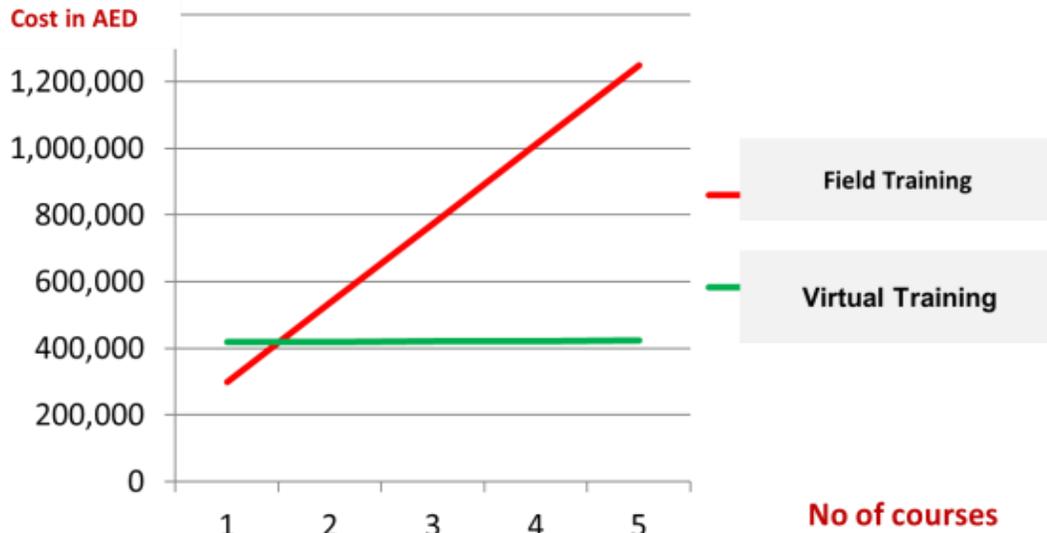


Chart 1: Increases in cumulative cost over number of courses (Virtual vs Field)

PLANS TO FURTHER DEVELOP THE INITIATIVE

In response to the ongoing challenges of traditional training methods—both in theory and practice—Dubai Police is committed to expanding its virtual training initiative into a fully immersive, scalable, and globally benchmarked ecosystem. The next phase of development will focus on harnessing advanced technologies, including Extended Reality (XR)—which encompasses Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR)—to create more dynamic and responsive training environments. Additionally, Dubai Police plans to begin the phased integration of Metaverse-based training platforms, enabling multi-user simulations in persistent, shared virtual spaces that replicate complex real-world environments and encourage collaborative decision-making.

Building on the success of the Traffic Accident Investigation (TAI) and Crime Scene modules, the initiative will expand to include advanced scenarios such as cybercrime investigations, mental health crisis response, border control, and emergency disaster management. These scenarios will be designed for deployment across smart glasses, VR headsets, and mobile devices, ensuring flexibility and accessibility for officers in the field and in command centers.

Technological upgrades will also include the use of AI-driven adaptive learning, eye-tracking, haptic feedback, and cloud-based hosting, allowing for personalized learning experiences, real-time performance analytics, and scalable deployment across departments and partner agencies. A centralized learning analytics dashboard will support data-driven insights to assess skill progression, identify training gaps, and evaluate operational readiness.

The initiative also emphasizes academic and institutional integration. Partnerships with local and international universities will enable the incorporation of XR modules into accredited law enforcement curricula, while work toward ISO/IEC 40180 compliance will ensure international training standards. Inclusive design will be prioritized to accommodate users of different physical and cognitive abilities, while energy-efficient hardware will support Dubai's broader sustainability goals.

Internationally, the initiative will support inter-agency and multinational exercises, offering multilingual, interoperable training modules deployable in the Metaverse. These virtual spaces will allow police units, military partners, and crisis response teams from different countries to jointly train in shared mission simulations, enhancing preparedness and global collaboration.

Through these future-focused developments, Dubai Police aims to redefine police training by combining physical, mental, and technological readiness. The expansion into XR and Metaverse environments ensures Dubai Police remains a global leader in the transformation of public safety training and law enforcement education.

CONCLUSION

Dubai Police is viewed as a pioneer in the region. It houses the first specialized in-house games development center in a police organization that focuses on developing serious games. In doing so, Dubai Police not only has managed to build a capital of intellectual property software assets, but it has also managed to build a human resources capital who have gained a wealth of expertise in using video game technologies to produce serious games that are effective in solving many different needs. Additionally, Dubai Police was the first police force in the world to build a simulation for traffic accident investigators.

Many things other organizations can learn from this practice:

- To keep updated with the latest developments in the different fields, especially the technological developments
- Higher education as a human capital investment yields great returns on the organization
- Build the idea, test it, do experiments in one field, and then, after it is approved, it is successful, and then replicate it to other fields.
- Teamwork
- Research & Development is essential for any organization
- Top Management support is very important for the success of any practice.
- Let the stakeholders be part of every step within the project to succeed.

The Success Factors in Implementing the Virtual Training are:

- Motivate staff by the leaders
- Explain to employees the importance of creativity and its impact on the workflow and employee excellence
- The involvement of staff in positive thinking
- Empowerment
- Availability of resources
- Training institutions for virtual training

The Virtual Technology Center will continue developing Virtual Training and awareness applications and will cover more fields in Dubai Police and other organizations.

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