



Investigating the Application of Multimedia Learning Principles in Dubai Police Smart Training Center: A Content Analysis

Ahmed Mohammed Al-Khalifi¹ , Nurulhuda Ibrahim² , Sobihatun Nur Abdul Salam³ 

Article History:

Received: 19-06-2025

Revision: 17-08-2025

Accepted: 22-08-2025

Publication: 10-09-2025

Cite this article as:

Al-Khalifi, A. M., Ibrahim, N., & Salam, S. N. A. S. (2025). Investigating the Application of Multimedia Learning Principles in Dubai Police Smart Training Center: A Content Analysis. *Journal of Intercultural Communication*, 25(3), 155-166. doi.org/10.36923/jicc.v25i3.1215

©2025 by author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License 4.0 International License.

Corresponding Author:

Ahmed Mohammed Al-Khalifi

School of Communication, Universiti Utara Malaysia, Kedah, Malaysia, and Senior Multimedia Design Specialist at Dubai Police. Email: a.mkhalifi@dubaipolice.gov.ae

Abstract: The integration of multimedia learning principles into institutional e-learning environments has become increasingly relevant in professional training contexts. However, limited attention has been given to how these principles are operationalized in law enforcement education. This study examines the application of established multimedia learning principles in the digital training modules of the Dubai Police Smart Training Center. A content analysis was conducted on thirty multimedia-enhanced courses, categorized by instructional level into introductory, intermediate, and advanced modules. The analysis focused on twelve principles derived from the Cognitive Theory of Multimedia Learning, assessing both adherence to and violations of these principles across course materials. Findings revealed inconsistent implementation of multimedia learning principles, with the Multimedia, Segmenting, and Spatial Contiguity principles observed more frequently than others. In contrast, Voice, Modality, Redundancy, Coherence, and Personalization were often applied in ways that diverged from recommended instructional design practices. No clear trends in adherence were associated with instructional level, indicating that design quality did not correspond to course complexity. These results suggest that multimedia elements are integrated without consistent reference to theoretical frameworks, highlighting the need for greater alignment between instructional design knowledge and digital content development. This study offers a foundation for continued examination of multimedia practices in specialized training contexts and recommends future research into the relationship between design implementation and learner experience, as well as the organizational factors that influence multimedia integration in professional education settings.

Keywords: Cognitive Theory of Multimedia Learning, Instructional Design, Multimedia Learning Principles, Police Training, Content Analysis

1. Introduction

The application of multimedia learning principles (MLPs) in e-learning continues to attract researchers' interest due to its potential to enhance student focus and knowledge retention. The Cognitive Theory of Multimedia Learning (CTML), developed by Mayer, posits that well-organized multimedia components can improve cognitive processing when they align with the brain's natural mechanisms for storing information (Mayer, 2024). In law enforcement training, digital media platforms have become essential tools for recreating realistic scenarios and strengthening officers' procedural understanding and decision-making abilities (AlAli & Alshamsi, 2023; Alzaabi et al., 2021; Awadh et al., 2020). However, there is a lack of research on how multimedia course components in the Dubai Police Smart Training Center align with evidence-based instructional design principles, despite the widespread use of e-learning for specialized police training (AlAli & Alshamsi, 2023; Alrazaqi, 2023). This study evaluates the extent to which MLPs are applied within Dubai Police e-learning modules by analyzing the multimedia content of training courses.

Research in both educational and criminological fields confirms that e-learning plays a vital role in law enforcement by offering scenario-based and interactive practices that enhance officers' knowledge and response capabilities (Spridzans, 2024; Yang, 2024). While the effectiveness of multimedia training in high-risk occupational performance is well documented, challenges remain in the design, selection, and implementation of components, often resulting in suboptimal training outcomes (Çeken & Taşkın, 2022). Most current studies on multimedia training are centered around higher education and corporate settings, with limited attention given to police training environments. This study addresses that gap by systematically evaluating the Dubai Police e-learning modules, categorizing their multimedia elements by both functional type and adherence to MLPs.

The purpose of this study is to investigate the extent to which multimedia learning principles are integrated into the e-learning modules of the Dubai Police Smart Training Center, and to assess the consistency of their application across different instructional levels. Although CTML provides a well-established theoretical framework for designing effective multimedia instruction, limited research has examined its practical application in professional law enforcement training contexts. By systematically analyzing course content against twelve established MLPs, this study aims to identify patterns of adherence and violation that may impact instructional quality and alignment. The research addresses a notable gap in the literature

^{1,2,3}School of Multimedia Technology and Communication, Universiti Utara Malaysia, Kedah, Malaysia

by focusing on an under-researched domain where operational demands, high-stakes decision-making, and continuous professional development converge with digital learning. While CTML has been extensively applied in academic contexts, its integration into police e-learning remains largely unexplored. Therefore, this study represents a novel contribution to both instructional design research and the policing sector's training literature. Moreover, the insights generated aim to provide an evidence-based overview of current multimedia design practices within Dubai Police, while informing future instructional strategies that are better aligned with proven cognitive and instructional principles.

2. Literature Review

2.1. Related Studies

Educational research has extensively explored the application of Multimedia Learning Principles (MLPs) in digital instructional environments to understand their impact on students' cognitive processes, attention, and knowledge acquisition (Mayer, 2020, 2024; Ramlatchan, 2019). Globally, law enforcement agencies have increasingly integrated digital learning platforms into their training strategies, utilizing interactive, scenario-based modules to enhance operational readiness and decision-making capabilities (AlAli & Alshamsi, 2023; Alrazooqi, 2023; Awadh et al., 2020; Yang, 2024). Although multimedia components have been shown to improve learning outcomes in high-risk procedural training contexts (Mayer, 2024), there remains a lack of systematic assessment of their effectiveness within police training environments. This literature review examines three critical domains relevant to the present study: (1) Multimedia Learning Principles and Instructional Design, (2) E-Learning in Law Enforcement Training, and (3) Content Analysis as a Method for Assessing Multimedia Quality in Instructional Design.

2.2. Multimedia Learning Principles and Instructional Design

The Cognitive Theory of Multimedia Learning (CTML), developed by Mayer (2020, 2024), serves as a foundational framework for understanding how learners process information in multimedia environments. The theory suggests that meaningful learning occurs when information is presented in a way that engages both the visual/pictorial and auditory/verbal channels while avoiding cognitive overload. Mayer's twelve Multimedia Learning Principles (MLPs) build on this foundation by offering design guidelines that support dual-channel processing, promote active cognitive engagement, and respect the limitations of working memory. As illustrated in Figure 1, visual and auditory processing channels operate in tandem during learning; therefore, instructional content must be concise, well-organized, and free from extraneous elements to be effective.

Although CTML is widely recognized in academic literature (Mayer, 2020, 2024), its application has largely been confined to traditional educational settings, often neglecting more complex, task-oriented training environments such as law enforcement (Halford & Youansamouth, 2024; Lemmetty, 2024). In these professional contexts, the quality of multimedia design can influence not only comprehension but also operational decision-making (Çeken & Taşkın, 2022). As emphasized by Mutlu-Bayraktar et al. (2019), many multimedia systems fail to consistently implement CTML-aligned MLPs, commonly due to overreliance on on-screen text, insufficient content segmentation, or poor synchronization between visual and auditory elements. These shortcomings underscore the need to evaluate how well CTML principles are applied, or overlooked, in professional training programs. This theoretical foundation underpins the present study's aim: to assess the degree to which multimedia elements in Dubai Police e-learning modules conform to CTML-based instructional design principles.

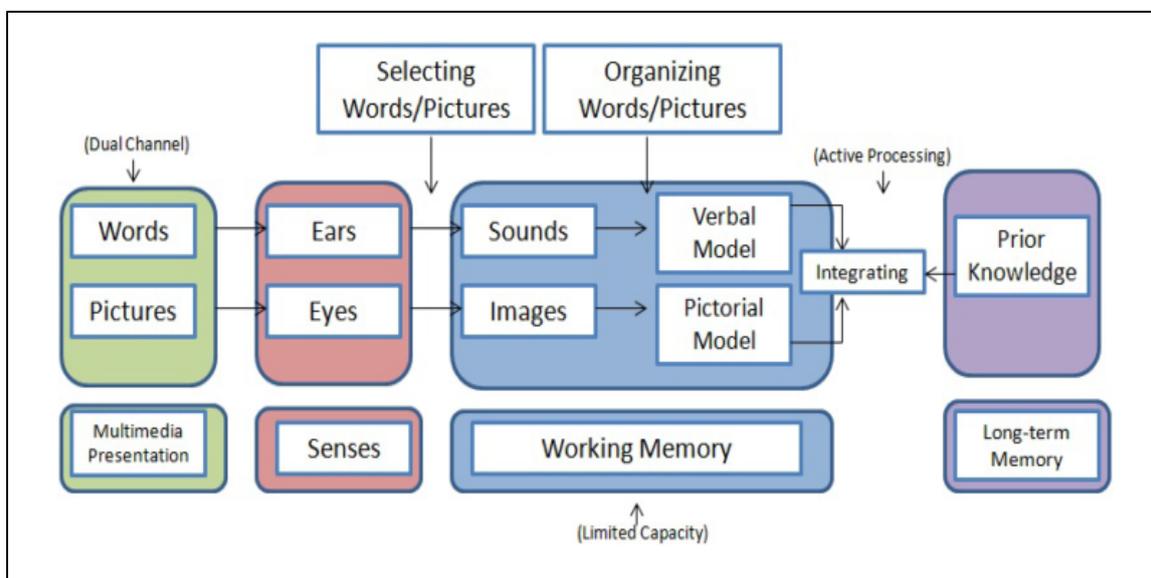


Figure 1: Cognitive Theory of Multimedia Learning. Source: Mayer's Cognitive Theory of Multimedia Learning (Mayer, 2008).

Mayer (2020, 2024) outlines twelve key principles of multimedia learning, illustrated in Table 1, which guide the design and effectiveness of instructional e-learning materials.

The principles outlined in CTML become especially critical when designing digital training for law enforcement officers, who must rapidly acquire complex information and apply it in high-pressure operational contexts. According to Lemmetty (2024), while remote and digital learning environments offer flexibility and scalability in police and technology organizations, long-term adoption faces constraints such as digital fatigue, lack of engagement, and organizational inertia. These are considered significant challenges that may hinder sustained learning outcomes, even when content is well-structured.

Table 1: Mayer's 12 Multimedia Learning Principles

No.	Principle	Description
1	Multimedia Principle	Learning reaches higher levels when text information joins visual material compared to text information used in isolation.
2	Coherence Principle	Students avoid cognitive overload when instructors remove teaching elements that do not connect to learning targets.
3	Signaling Principle	Effective learner attention directive arises through the use of highlighting techniques such as bold text and arrows.
4	Redundancy Principle	Learning is affected when students receive identical information through both screen text and narration at the same time, so it is better to use a single modality.
5	Spatial Contiguity Principle	The proximity of screen-based text to related visuals improves understanding of the content.
6	Temporal Contiguity Principle	A proper synchronization between sound and visual elements helps people understand information better.
7	Segmenting Principle	The strategy of segmenting difficult learning material into smaller units enables learners to approach information independently at their individual processing speed.
8	Pre-training Principle	Presenting major ideas in advance helps learners understand upcoming challenging information.
9	Modality Principle	The combination of narration with visuals proves more effective than having text displayed on screen for delivering information to learners.
10	Personalization Principle	The use of daily language within narrative sections helps both students and teachers to become more interested in the material.
11	Voice Principle	The use of a human voice in narration produces better results compared to a man-made synthetic or robotic audio voice.
12	Image Principle	Using instructor images in learning materials does not always provide benefit unless the images aid in achieving the instructional objectives.

Çeken and Taşkın's (2022) systematic review confirms that, although MLPs are widely promoted across learning environments, their implementation is often inconsistent, especially in real-world, practical settings where design is constrained by contextual limitations. Importantly, they highlight that misapplication of principles such as redundancy, modality, and coherence can actually increase cognitive load, particularly when learners are exposed to excessive or poorly aligned multimedia content.

Although Mutlu-Bayraktar et al. (2019) emphasize the theoretical value of cognitive load-informed design, their findings suggest that many implementations fail to manage complexity effectively, often lacking learner-centric segmentation or adaptive delivery. Collectively, these studies underscore the importance of empirically examining how multimedia design principles are applied within sector-specific contexts. The current study addresses this gap by analyzing the integration of MLPs in Dubai Police e-learning modules through an evaluative content analysis grounded in CTML.

2.3. E-Learning in Law Enforcement Training

Integrating E-learning has gained popularity in law enforcement training in recent years, driven by the need to improve accessibility, efficiency, and cost-effectiveness in professional education. However, the implementation of digital learning environments in policing remains inconsistent and often lacks pedagogical depth. Belur et al. (2023) note that although online and blended learning are becoming more common in police academies, many programs continue to rely on traditional, lecture-based approaches, merely transferred to a digital format, rather than adapting instructional design for multimedia use. This limits opportunities for active learning and underutilizes the potential of digital platforms.

Further, Belur et al. (2021) found that while some digital training programs report positive learner satisfaction, there is limited evidence of their long-term impact on real-world performance or decision-making. Digital content in police training is frequently developed without aligning with how officers learn most effectively, through active problem-solving, simulation, and contextualized feedback. This disconnect reflects a broader gap between technology adoption and instructional quality.

Halford and Youansamouth (2024) raise similar concerns, arguing that many digital initiatives in police training are introduced primarily to meet compliance objectives rather than to improve learning outcomes. Their study highlights how rigid training cultures, insufficient instructor support, and limited learner engagement contribute to the underutilization of instructional strategies grounded in educational theory. As such, instructional design frameworks like Mayer's CTML are rarely applied systematically in police training environments.

Despite these challenges, Dubai Police provides a notable example of investment in technology-enhanced learning. As described by AlRazooqi (2023), the Virtual Technology Center has developed a range of simulation-based training programs that replicate real-world policing scenarios, such as traffic accidents, crime scenes, and tactical interventions, using interactive, game-based platforms. These are intended to offer immersive, learner-centered educational experiences. However, as Alzaabi et al. (2021) point out, technological innovation alone is insufficient; the effectiveness of such programs ultimately depends on the quality of instructional design, particularly the organization of visual and verbal content to manage cognitive load and promote knowledge transfer, central concerns in CTML.

Additionally, recent developments in metaverse-based training show potential for creating more engaging and flexible learning environments. In their study, AlAli and Alshamsi (2023) found that academy-level learners responded positively to the realism and autonomy offered by metaverse systems. Nevertheless, they cautioned that these technologies require rigorous planning and consistent instructional design standards to be effective at scale. Similar findings were reported by Abdulrahman et al. (2020) in a study on police cadets in Nigeria, which revealed enthusiasm for digital learning but also highlighted barriers such as poor infrastructure and limited digital literacy, especially among trainers.

Jenkins et al. (2021) emphasize that scenario-based training (SBT) in police education must go beyond mere realism to include structured learning objectives, clear feedback mechanisms, and deliberate pacing. They argue that SBT should be deployed progressively across training phases to support the development of cognitive, emotional, and behavioral competencies essential for real-world performance. This perspective aligns with the findings of Lemmetty (2024), who examined learner motivation and engagement in remote law enforcement learning environments. Her study showed that even advanced digital tools may fail to engage learners if the content lacks relevance or does not align with their personal goals.

Taken together, these studies highlight the need for multimedia police training environments that are not only interactive and realistic but also grounded in established learning principles and responsive to learner needs.

The aforementioned literature indicates a growing shift toward digital and interactive learning in law enforcement. However, the design of these systems often lacks consistency and alignment with established instructional theories. This discrepancy raises key questions about how effectively MLPs are implemented in police e-learning programs. The present study addresses this issue by evaluating the extent to which Dubai Police's digital training courses align with CTML principles, providing insights into current practices and areas for improvement. Despite the widespread adoption of multimedia strategies in education, little is known about how these principles are applied within law enforcement contexts, particularly in organizations with advanced digital infrastructure. The Dubai Police Smart Training Center offers a unique opportunity to examine this application within a security-focused e-learning ecosystem.

2.4. Dubai Police Smart Training Center

The General Department of Training at Dubai Police has long prioritized the professional development of both military and civilian personnel through specialized training in criminal, traffic, and administrative domains. In 2017, the department launched the Smart Training Center (STC), a web-based platform designed to modernize traditional classroom-based police education through the use of multimedia-enhanced digital learning.

This initiative reflects a broader global trend in law enforcement, where digital platforms are increasingly used to deliver scalable, flexible instruction. However, as police organizations adopt these technologies, important questions arise regarding their alignment with instructional design principles, particularly those outlined in CTML. Although the STC features interactive e-learning materials and synchronous delivery mechanisms, it remains unclear to what extent its course content adheres to evidence-based multimedia design standards.

With more than 39,000 trainees enrolled in 2021 alone (AlBayan, 2022), there is a pressing need to evaluate the instructional quality of STC's multimedia components. Rather than assessing learning outcomes, this study focuses on design adherence, specifically examining how the Dubai Police STC modules align with Mayer's Multimedia Learning Principles. The findings aim to inform ongoing improvements in instructional strategy and design quality across police e-learning environments.

3. Research Methodology

Qualitative content analysis was employed in this study to evaluate how the Dubai Police utilize Multimedia Learning Principles (MLPs) in their e-learning course delivery. Content analysis is a foundational research method widely used in educational technology and instructional design to systematically assess digital learning resources (Arguelles, 2017; Kew & Tasir, 2021; Pyrchenkova & Radchenko, 2021). A standardized assessment framework guided the evaluation of multimedia components found within educational modules by examining their types, placements, and adherence to quality standards.

This section outlines the research design, data collection methods, sample selection strategy, and the evaluation criteria applied in the study. Qualitative content analysis was chosen to identify patterns and categorize multimedia components while evaluating their instructional value in Dubai Police e-learning courses. This approach allowed for a comprehensive evaluation of how multimedia elements are integrated into law enforcement training programs (Pyrchenkova & Radchenko, 2021). The study analyzed each multimedia element within selected course modules across three primary categories: videos (as explanatory tools), pictures (as illustrative aids), and simulations (as interactive components).

The content analysis used a criterion-based evaluation framework to assess the alignment of each multimedia component with Mayer's MLPs. Multimedia usage was examined across different instructional stages, introductory, intermediate, and advanced, to explore variations in teaching strategies. It is important to note that this study did not assess learner outcomes or performance data. As such, all interpretations are presented descriptively through the lens of CTML, without drawing causal conclusions about instructional effectiveness.

3.1. Content Analysis as a Method for Evaluating Multimedia Quality

Content analysis is widely accepted among educational technology researchers as a method for evaluating the structure, functionality, and effectiveness of digital learning environments based on multimedia components (Kumar et al., 2023; Ng et al., 2023). This methodology benefits e-learning assessments by enabling objective classification of learning resources (Kuckartz & Rädiker, 2023; Riffe et al., 2023). In multimedia instructional design, content analysis is crucial for evaluating digital learning quality, adherence to MLPs, and identifying design shortcomings (Arguelles, 2017).

Content analysis has been frequently used in studies assessing digital learning across various educational contexts. In higher education, researchers apply this method to evaluate how instructional videos, interactive media, and simulations are integrated into university-level e-learning platforms (Kew & Tasir, 2021; Maphalala & Adigun, 2021). It also produces evidence-based insights that help improve training module design across industries (Kuckartz & Rädiker, 2023). Within the policing context, content analysis has been used to assess engagement quality, usability, and instructional integrity in multimedia-based training programs (Pyrchenkova & Radchenko, 2021).

In this study, content analysis was applied to Dubai Police e-learning courses to classify multimedia components based on their educational function, explanatory, illustrative, or interactive, and to evaluate their compliance with MLPs. The research aims to assess how effectively multimedia design in police training aligns with instructional best practices using a standardized evaluation system. The findings offer valuable insights into the quality and design consistency of multimedia resources and contribute to the enhancement of digital training for law enforcement personnel.

3.2. Data Collection and Sampling Strategy

A stratified random sampling method was used to select thirty multimedia-enhanced e-learning courses from the Dubai Police Smart Training Center's digital platform. The sampling approach ensured representative coverage across varying levels of instructional complexity and subject matter areas. First, all available courses were classified into three instructional tiers, Introductory, Intermediate, and Advanced, and further grouped into subject domains, including criminal procedures, traffic enforcement, administrative operations, and cross-functional skills. From this stratified population, ten modules per instructional level were randomly selected, resulting in a final sample of thirty courses.

These courses were categorized as follows:

1. Introductory-level courses introduce foundational policing principles, legal frameworks, and public interaction protocols.
2. Intermediate-level courses offer specialized content that builds on prior knowledge, typically covering procedural systems or task-specific operations.
3. Advanced-level courses are designed for experienced officers or specialized units and focus on topics such as operational tactics, digital forensics, and leadership development.

In total, 85 multimedia elements were identified within the selected modules, forming the units of analysis for this study. These elements were further categorized into three main multimedia types, as summarized in Table 2.

Table 2: Classification of Multimedia Elements in Dubai Police E-Learning Courses

Multimedia Category	Definition	Number of Elements Identified
Explanatory (Videos)	The instructional use of videos presents explanations combined with demonstrations of procedures and guidance for learners.	5
Illustrative (Images & Text-Based Lessons)	Static illustrations and images together with textual information form visual explanations.	5
Interactive (Multimedia Activities & Simulations)	Interactive exercises, scenario-based simulations, or virtual assessments.	75
Total Multimedia Elements		85

Source: Calculated by the author

3.3. Evaluation Framework and Content Analysis Criteria

The evaluation framework for this study was based on the twelve principles of multimedia learning as defined by the Cognitive Theory of Multimedia Learning (CTML). These principles served as coding categories against which multimedia elements were examined in the selected e-learning modules from the Dubai Police Smart Training Center. The decision to adopt CTML as the evaluative lens was informed by its well-established role in improving learning through effective use of visual and auditory channels, minimizing extraneous cognitive load, and fostering active learner engagement. In high-stakes policing contexts, where trainees must rapidly acquire complex operational knowledge under time pressure and stressful conditions, the degree to which these principles are applied can significantly affect the accuracy, retention, and transferability of learning.

Each of the twelve multimedia principles was translated into specific, tangible criteria to ensure consistent coding, as summarized in Table 3. These criteria offered clear parameters for identifying whether a principle was adhered to or violated. For instance, the Modality Principle was evaluated by determining whether narration was used instead of redundant on-screen text, while the Coherence Principle was assessed by examining the exclusion of unnecessary visuals, sounds, or animations that might distract from core instructional content. Other criteria included the Segmenting Principle, which involved breaking complex procedures into operational steps, and the Signaling Principle, which focused on the use of cues, such as arrows, highlights, or color emphasis, to direct learner attention to key information.

Table 3: Evaluation/Analysis Form

Multimedia Learning Principle	Description	Assessment Criteria
1. Multimedia Principle	Convey information via both textual descriptions and pertinent pictures.	Presence of textual and visual elements together in courseware.
2. Coherence Principle	Ensure the words and visuals are logically integrated.	Logical flow and alignment of text and visuals within modules.
3. Signaling Principle	Use cues to highlight essential information.	Presence of cues or indicators for important concepts or sections.
4. Redundancy Principle	Avoid presenting the same information in both words and visuals.	Identification of redundant elements within modules.
5. Spatial Contiguity Principle	Present words near corresponding visuals.	Spatial arrangement of text and visuals within the courseware.
6. Temporal Contiguity Principle	Present words and visuals simultaneously.	Timing of text and visual elements during module presentation.
7. Segmenting Principle	Divide content into manageable segments.	Identification of content segmentation and module structure.
8. Pre-Training Principle	Provide introductory information before presenting complex material.	Inclusion of introductory sections or prerequisites in modules.
9. Modality Principle	Use animation and narration rather than animation and on-screen text.	Evaluation of the use of animation, narration, and on-screen text.
10. Personalization Principle	Use conversational rather than formal language.	Analysis of the language style and tone used in courseware.

Multimedia Learning Principle	Description	Assessment Criteria
11. Voice Principle	Use a friendly human voice rather than a machine-like voice.	Evaluation of the voice used in narrations.
12. Image Principle	Use images that support the learning objective.	Assessment of the image layout, placement, and visual simplicity.

Source: Descriptions adapted from Mayer (2009); assessment criteria developed by the researcher.

To illustrate the application of these criteria, Figure 2 presents a coding example from the content analysis conducted using NVivo 15. The example is taken from a module on managerial effectiveness and efficiency. Analysis revealed a violation of the Spatial Contiguity Principle, where related text and images were placed far apart on the screen, forcing learners to shift focus unnecessarily. A violation of the Coherence Principle was also noted, as the module included non-essential background animations and sound effects. These design choices introduced extraneous cognitive load and distracted learners from the main instructional goals. Examples such as this demonstrate how the evaluation framework was applied in practice and enhance transparency in the classification process.

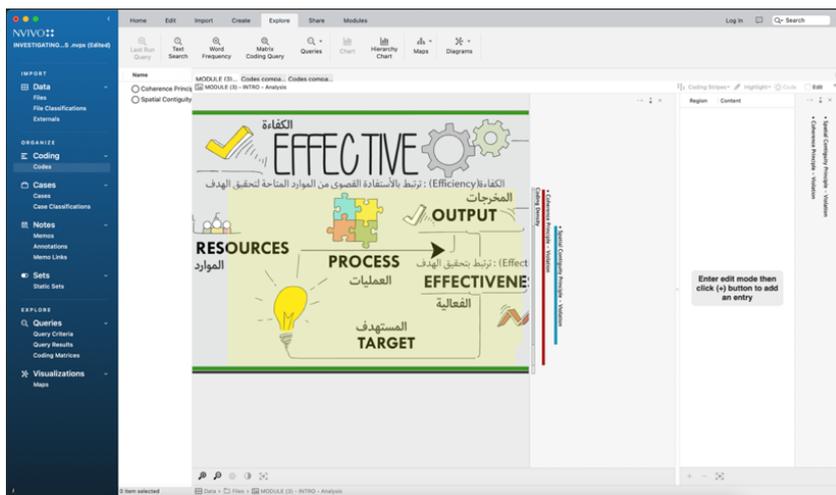


Figure 2: Example of coding illustrating violations of selected multimedia learning principles in a training module.

This structured approach ensured that coding decisions were grounded in both theoretical constructs and observable design features. Additionally, the framework enabled systematic comparison across different instructional levels within the course sample. This facilitated an analysis not only of overall patterns of adherence but also of variations linked to instructional complexity. The next section presents the findings of this analysis, detailing the frequency and distribution of principle adherence and violations across the evaluated e-learning modules.

4. Findings

4.1. Multimedia Integration in Dubai Police E-Learning

A detailed analysis of multimedia elements in Dubai Police e-learning courses was conducted, examining both their distribution patterns and alignment with Multimedia Learning Principles (MLPs). The results, as illustrated in Figure 3, are organized into three interrelated areas: (1) the distribution and frequency of multimedia elements across evaluated courses, (2) the extent to which MLPs were applied or violated, and (3) the identification of patterns that reveal both strengths and areas needing improvement.

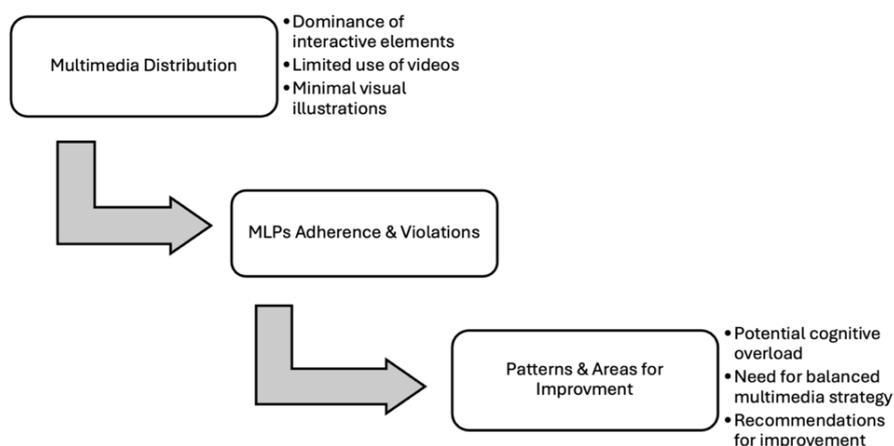


Figure 3: Summary of findings.

4.2. Distribution and Frequency of Multimedia Elements

The evaluation of thirty selected e-learning courses revealed a total of 85 multimedia elements, which were grouped into three categories: explanatory (videos), illustrative (images and text-based lessons), and interactive (multimedia activities and simulations) (see Figure 4). The data indicates that interactive multimedia dominates the content structure, accounting for 82.3% of the multimedia elements, compared to videos (9.4%) and pictures with text (8.3%).

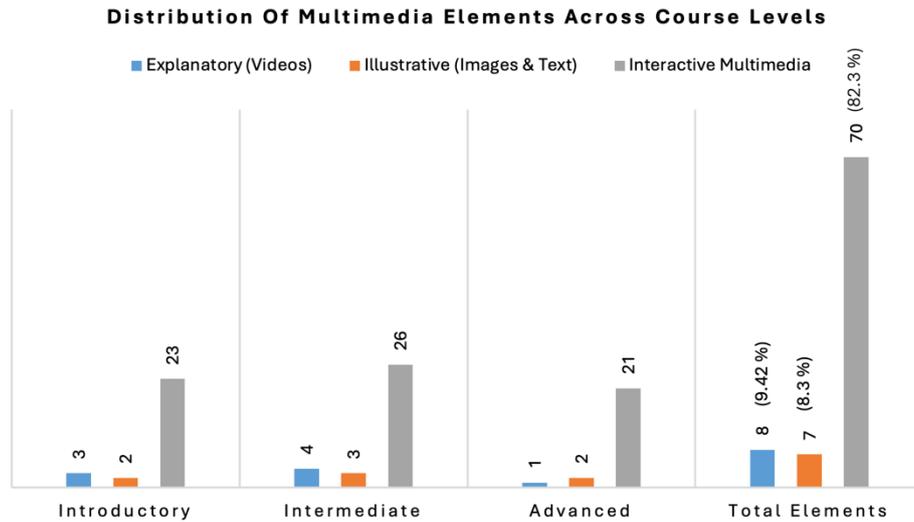


Figure 4: Distribution of multimedia elements across course levels.

Source: Researcher-generated chart based on evaluation of 30 e-learning courses from the Dubai Police Smart Training Center.

4.3. Analysis of Multimedia Learning Principles Applied and Violated

The assessment revealed varying degrees of adherence to MLPs across the e-learning programs. Among the principles, the Multimedia Principle was one of the most consistently applied, particularly in modules incorporating interactive visual elements (see Table 4). The integration of images and text in these modules supported dual-channel processing, aligning well with CTML's core assumptions. The Segmenting Principle was also commonly observed, with content divided into manageable sections that learners could progress through at their own pace. Additionally, the Signaling Principle was effectively implemented in many instances through the use of arrows, highlights, and bold keywords to guide learner attention (see Figure 5).

Table 4: Summary of Multimedia Learning Principles (MLP) Application

No	Multimedia Learning Principle	Total Adherence Count	Adherence Percentage (%)	Total Violation Count	Violation Percentage (%)
1	Multimedia Principle	72	84.70%	13	15.30%
2	Segmenting Principle	60	70.60%	25	29.40%
3	Signaling Principle	56	65.90%	29	34.10%
4	Modality Principle	22	25.90%	63	74.10%
5	Coherence Principle	37	43.50%	48	56.50%
6	Redundancy Principle	42	49.40%	43	50.60%
7	Spatial Contiguity Principle	62	72.90%	23	27.10%
8	Temporal Contiguity Principle	57	67.10%	28	32.90%
9	Pre-training Principle	27	31.80%	58	68.20%
10	Personalization Principle	15	17.60%	70	82.40%
11	Voice Principle	20	23.50%	65	76.50%
12	Image Principle	22	25.90%	63	74.10%

Source: Calculated by the author

Despite these strengths, several notable violations of MLPs were also identified, especially in principles that CTML emphasizes for minimizing extraneous cognitive processing. The Modality Principle was among the most frequently violated, with many modules relying heavily on on-screen text instead of auditory narration. According to CTML, this design choice places additional demands on the visual processing channel, potentially reducing learning efficiency. Although the study does not directly assess learner outcomes, the high frequency of modality violations signals a recurring misalignment with best practices in multimedia design.

Despite these strengths, several notable violations of MLPs were also identified, especially in principles that CTML emphasizes for minimizing extraneous cognitive processing. The Modality Principle was among the most frequently violated, with many modules relying heavily on on-screen text instead of auditory narration. According to CTML, this design choice places additional demands on the visual processing channel, potentially reducing learning efficiency. Although the study does not directly assess learner outcomes, the high frequency of modality violations signals a recurring misalignment with best practices in multimedia design.



Figure 5: Application of the Signaling Principle.

Source: Screenshot from a Dubai Police Smart Training Center module, annotated by the researcher to illustrate application and violation of principles.

Similarly, the Coherence Principle was inconsistently upheld. Numerous modules included non-essential animations, background sounds, or visual clutter that diverted attention from core instructional material. Violations of the Redundancy and Personalization Principles were also common, especially in modules where on-screen text was presented simultaneously with narration, resulting in repetitive input that CTML cautions can impair learning.



Figure 6: Violation of the Spatial Contiguity Principle.

Source: Screenshot from a Dubai Police Smart Training Center module, annotated by the researcher to illustrate application and violation of principles.

As illustrated in Figure 6, violations of the Spatial and Temporal Contiguity Principles were also observed. Learners were often required to shift focus unnecessarily when photographs and corresponding descriptive text were separated on screen. In several cases, the synchronization between spoken commentary and visual elements was poorly timed, leading to fragmented and less cohesive content delivery, as interpreted through CTML guidelines.

When comparing MLP adherence across the three instructional levels, no consistent or theoretically predictable pattern emerged. This suggests that course complexity does not reliably predict the quality of multimedia design. While Segmenting and Signaling Principles appeared across all levels with moderate frequency, their presence did not reflect a structured instructional strategy. This challenges the assumption that simpler or linear courses, such as those at the introductory level, inherently promote stronger alignment with CTML. In fact, Modality violations were particularly prominent in intermediate-level modules, where dense content was presented using extensive on-screen text without accompanying narration. This supports findings by Çeken and Taşkın (2022), who noted that violations of Modality and Redundancy Principles are frequently reported even in structured instructional environments.

Adherence to Coherence and Redundancy principles varied unpredictably across course levels, further suggesting that design decisions may be driven more by production habits than instructional intent. These inconsistencies align with Lemmetty's (2024) assertion that institutional digital learning platforms often face uneven instructional design implementation due to constraints such as limited time, expertise, or platform flexibility. Surprisingly, Introductory modules, intended for newer learners, showed significant inconsistency in applying Personalization and Voice Principles, despite the fact that such learners would benefit most from user-sensitive design.

Collectively, these findings indicate that MLP adherence is influenced less by course complexity and more by a combination of contextual, procedural, and organizational factors. The overall distribution of these patterns is represented in Figure 7.

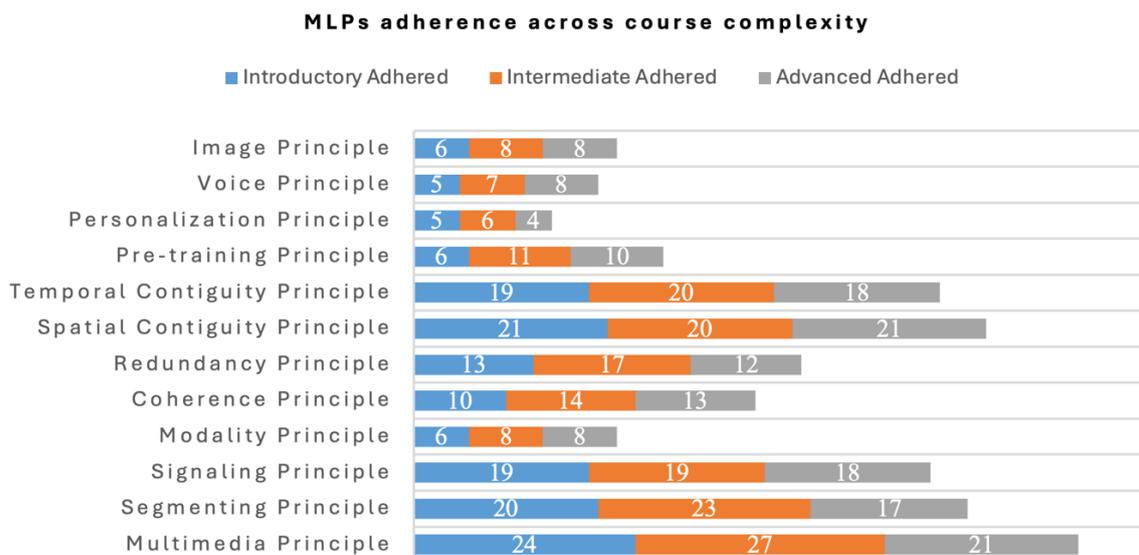


Figure 7: Distribution of MLPs adherence across course complexity levels.

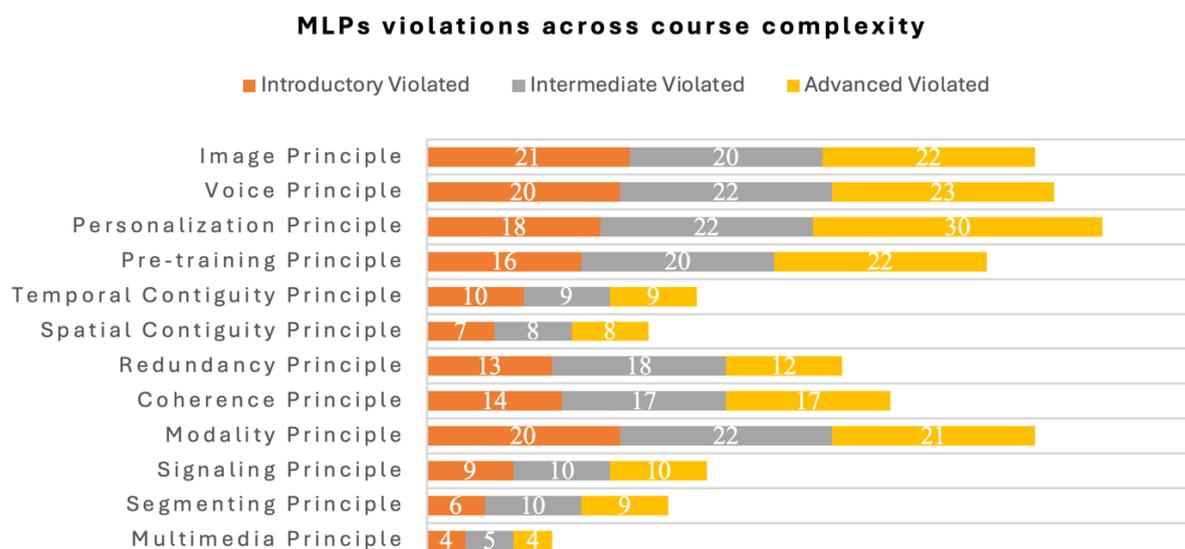


Figure 8: Distribution of MLP violations across course complexity levels.

4.4. Areas for Improvement in Adherence to Multimedia Learning Principles

Optimizing the instructional design of Dubai Police e-learning modules requires targeted interventions to address common violations of key Multimedia Learning Principles (MLPs), particularly the frequently violated Personalization Principle. Efforts to adopt a more conversational, learner-centered tone in content delivery could increase engagement and cognitive processing in professional training environments.

Likewise, improved adherence to the Modality Principle is essential. Replacing dense on-screen text with well-paced narration supported by meaningful visuals can help reduce cognitive load and enhance learning. To strengthen the Coherence Principle, designers should remove unnecessary animations, decorative visuals, and irrelevant audio. For the Redundancy Principle, avoiding verbatim duplication of text and narration is crucial.

In support of Spatial and Temporal Contiguity, instructional designers should focus on aligning and sequencing text and images more precisely to allow for integrated content processing. Addressing these design issues will require the adoption of a structured multimedia design process, including clear design guidelines, standardized templates, and rigorous review procedures.

Such measures would enable more consistent application of MLPs across e-learning courses, improving cognitive efficiency and ensuring that police officers are better equipped with the knowledge, skills, and decision-making abilities required in high-performance operational environments.

5. Discussion

The analysis revealed widespread inconsistencies in the application of Multimedia Learning Principles (MLPs) across the Dubai Police Smart Training Center's e-learning modules. While principles such as Segmentation and Signaling were observed in various modules, their application often lacked a clear instructional rationale. This reflects broader challenges identified in the literature, such as those noted by Çeken and Taşkın (2022), who found that many multimedia components are implemented without explicit alignment to instructional models. Similarly, Mutlu-Bayraktar et al. (2019) identified a common tendency to use multimedia elements more for visual appeal than as evidence-based learning strategies.

Frequent violations of the Modality and Redundancy Principles were especially apparent, particularly in intermediate-level modules that relied heavily on text-heavy slides without accompanying narration or that duplicated content across modalities. Such practices undermine cognitive efficiency and demonstrate a disconnect between instructional theory and design, often due to institutional pressures, limited design expertise, or lack of formal training in multimedia learning. In advanced modules, the Coherence Principle was applied inconsistently, with examples of visual clutter, decorative animations, and irrelevant background elements that distracted from the core instructional content. These findings align with Lemmetty's (2024) observations that design decisions in institutional settings are often guided more by production routines than pedagogical clarity.

Equally significant was the lack of a consistent pattern in MLP adherence across instructional levels. Contrary to expectations, introductory modules did not demonstrate superior alignment with multimedia principles compared to more advanced ones. Violations of the Redundancy and Personalization Principles were observed across all levels, reinforcing Lemmetty's (2024) assertion that design quality is influenced more by organizational workflows and systemic support than by course complexity. Particularly underutilized were the Personalization and Voice Principles, which, if consistently applied, could enhance learner engagement and motivation (Mayer, 2020). Their minimal use suggests that learner-centered design approaches have yet to become embedded in development practices.

This supports earlier findings by Mutlu-Bayraktar et al. (2019), who highlighted that institutional e-learning environments often prioritize technical delivery over cognitive-affective support. The uneven and sporadic enforcement of multimedia principles across modules reflects broader cultural and operational issues in instructional design, such as limited access to design expertise, fragmented communication between content experts and developers, and a lack of standardized quality assurance processes.

Taken together, the findings reveal a significant gap between instructional theory and the practical implementation of multimedia design in professional law enforcement training. While some principles are applied with moderate consistency, others are frequently overlooked or misapplied, often in ways that deviate from established cognitive guidelines. These trends suggest that current multimedia integration is likely shaped more by production constraints and habitual practices than by deliberate instructional planning. Further research is needed to explore how institutional conditions, design workflows, and stakeholder roles contribute to these inconsistencies and how they might be addressed to achieve better alignment between practice and theory.

5. Conclusion

This study investigated the extent to which Multimedia Learning Principles (MLPs) are applied in the e-learning modules developed by the Dubai Police Smart Training Center. Through a structured content analysis of thirty multimedia-enhanced courses, the research identified varying levels of alignment with principles derived from cognitive design theory. While some principles, such as Segmentation and Signaling, were observed, their application lacked consistency. More notably, violations of the Modality, Redundancy, Coherence, and Personalization Principles were frequent, indicating that adherence to MLPs is uneven across the analyzed digital training content.

No clear relationship was found between instructional level and principle adherence, as both compliance and violations occurred across introductory, intermediate, and advanced courses. These results highlight a disconnect between the theoretical foundations of multimedia learning and their practical implementation in a professional training context. Rather than being systematically embedded, MLPs appear to be applied selectively and without a consistent instructional rationale.

For instructional designers, the findings underscore the importance of deliberately integrating evidence-based principles when developing content for professional learning environments. Although this study does not assess learner outcomes or engagement directly, it provides a foundational understanding of current design practices and highlights critical areas for improvement. Future research should explore how institutional processes, instructional design protocols, and capacity-building efforts influence the implementation of multimedia principles, offering a path toward more pedagogically effective and consistent e-learning development.

6. Implication for Future Research

While this study provides a descriptive overview of the use of multimedia learning principles in a professional law enforcement training context, several important avenues remain for future research. Subsequent studies could examine the relationship between the quality of multimedia design and measurable learning outcomes such as knowledge retention, skill acquisition, and operational performance. Longitudinal research could explore the sustained impact of multimedia-based training on long-term behavior and decision-making in the field.

Comparative studies across policing institutions or international contexts could also yield insights into how instructional design practices vary and how closely they align with global standards for police education. Further investigation into the instructional design decision-making process and learner experience, perhaps through mixed-methods approaches using interviews, surveys, or usability testing, could help clarify the practical challenges and opportunities in multimedia integration.

Emerging technologies such as adaptive learning platforms and artificial intelligence also offer promising research directions, particularly in personalizing training to individual learner needs. Although not addressed in this study, such innovations could be crucial in enhancing the flexibility and relevance of police training environments.

Taken together, these recommendations build on the findings of the present research and support the development of more effective, evidence-informed, and learner-centered e-learning models in law enforcement education.

Acknowledgement Statement: The authors would like to express their sincere gratitude to Universiti Utara Malaysia and the Dubai Police General Headquarters for their support and cooperation throughout this research. We also extend our heartfelt thanks to all participants who contributed their time and insights, as well as to the reviewers for their valuable comments and constructive feedback that greatly helped in the completion of this manuscript.

Conflicts of interest: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Authors' contribution statements: Ahmed Mohammed Al-Khalifi and Nurulhuda Ibrahim conceptualized and designed the study. Sobihatun Nur Abdul Salam performed the data collection and carried out the data interpretation and statistical analysis. Ahmed Mohammed Al-Khalifi wrote the original manuscript draft with support and critical review from Nurulhuda Ibrahim. Sobihatun Nur Abdul Salam; Nurulhuda Ibrahim supervised the overall project and guided throughout the research process. All authors reviewed and approved the final manuscript.

Funding statements: As there was no external funding received for this research, the study was conducted without financial support from any funding agency or organization.

Data availability statement: Data is available upon request. Please contact the corresponding author for any additional information on data access or usage.

Disclaimer: The views and opinions expressed in this article are those of the author(s) and contributor(s) and do not necessarily reflect JICC's or editors' official policy or position. All liability for harm done to individuals or property as a result of any ideas, methods, instructions, or products mentioned in the content is expressly disclaimed.

References

- Abdulrahman, M. D., Faruk, N., Oloyede, A. A., Surajudeen-Bakinde, N. T., Olawoyin, L. A., Mejabi, O. V., ... & Azeez, A. L. (2020). Multimedia tools in the teaching and learning processes: A systematic review. *Heliyon*, *6*(11), e05312. <https://doi.org/10.1016/j.heliyon.2020.e05312>
- AlAli, M., & Alshamsi, H. (2023). Integration of Metaverse technology into the police academy education and training system. *International Journal of Education (IJE)*, *11*(3), 1–8. <https://doi.org/10.5121/ije.2023.11301>
- AlBayan. (2022, January 9). *384,342 hours of training were completed by Dubai Police last year*. Retrieved from <https://www.albayan.ae/uae/news/2022-01-09-1.4342296>
- Alrazooqi, M. (2023). Virtual training in the police domain. *International Journal of Computer (IJC)*, *46*(1), 41–52. Retrieved from <https://core.ac.uk/download/pdf/555335050.pdf>
- Alzaabi, A. A. Y. A., Ghani, A. B. B. H. A., & Siam, M. R. A. (2021). The effect of e-learning training program on organizational performance through underlying mechanisms of capacity building of Dubai police force. *Academy of Entrepreneurship Journal*, *27*(2S), 1–25. Retrieved from <https://www.academia.edu/download/78930776/the-effect-of-e-learning-training-program-on-organizational-performance-through-underlying-mechanisms-of-capacity-buildin.pdf>
- Arguelles, V. (2017). *Investigating instructional designers' decisions regarding the use of multimedia learning principles in e-learning course design* (Doctoral dissertation). University of Central Florida.
- Awadh, A., Abudlhabib, A., & Al-Dhaafri, H. (2020). The impact of training methods on effective training process in Ajman Police: The moderating role of readiness for training. *Journal of Management Research*, *12*(2), 1–18. <https://doi.org/10.5296/jmr.v12i2.16483>
- Belur, J., Bentall, C., Glasspoole-Bird, H., & Laufs, J. (2021). *Blended learning for police learning and development: A report on the research evidence*. UCL Jill Dando Institute of Security and Crime Science.
- Belur, J., Glasspoole-Bird, H., Bentall, C., & Laufs, J. (2023). What do we know about blended learning to inform police education? A rapid evidence assessment. *Police Practice and Research*, *24*(1), 32–52. <https://doi.org/10.1080/15614263.2022.2073230>
- Çeken, B., & Taşkın, N. (2022). Multimedia learning principles in different learning environments: A systematic review. *Smart Learning Environments*, *9*(1), 1–22. <https://doi.org/10.1186/s40561-022-00200-2>
- Halford, E., & Youansamouth, L. (2024). Emerging results on the impact of COVID-19 on police training in the United Kingdom. *The Police Journal*, *97*(1), 105–130. <https://doi.org/10.1177/0032258X221137004>
- Jenkins, B., Semple, T., Quail, J., & Bennell, C. (2021). Optimizing scenario-based training for law enforcement. In C. Bennell, T. Semple, B. Jenkins, & P. J. Blumberg (Eds.), *Police training and education: Past, present and future* (pp. 18–37). IGI Global. <https://doi.org/10.4018/978-1-7998-6820-0.ch002>
- Kew, S. N., & Tasir, Z. (2021). Analysing students' cognitive engagement in e-learning discussion forums through content analysis. *Knowledge Management & E-Learning*, *13*(1), 39–57. <https://doi.org/10.34105/j.kmel.2021.13.003>
- Kuckartz, U., & Rädiker, S. (2023). *Qualitative content analysis: Methods, practice and software*. Sage.
- Kumar, S., Lim, W. M., Sivarajah, U., & Kaur, J. (2023). Artificial intelligence and blockchain integration in business: Trends from a bibliometric-content analysis. *Information Systems Frontiers*, *25*(2), 871–896. <https://doi.org/10.1007/s10796-022-10279-0>
- Lemmetty, S. (2024). Real-time and long-term challenges of remote learning and innovation: Cases from police and technology organisations. *Vocations and Learning*, *17*(3), 565–587. <https://doi.org/10.1007/s12186-024-09354-1>
- Maphalala, M. C., & Adigun, O. T. (2021). Academics' experience of implementing e-learning in a South African higher education institution. *International Journal of Higher Education*, *10*(1), 1–13. <https://doi.org/10.5430/ijhe.v10n1p1>
- Mayer, R. E. (2020). *Multimedia learning* (3rd ed.). Cambridge University Press. <https://doi.org/10.1017/9781316941355>
- Mayer, R. E. (2024). The past, present, and future of the cognitive theory of multimedia learning. *Educational Psychology Review*, *36*(1), 8. <https://doi.org/10.1007/s10648-023-09842-1>

- Mutlu-Bayraktar, D., Cosgun, V., & Altan, T. (2019). Cognitive load in multimedia learning environments: A systematic review. *Computers & Education*, *141*, 103618. <https://doi.org/10.1016/j.compedu.2019.103618>
- Ng, D. T. K., Ching, A. C. H., & Law, S. W. (2023). Online learning in management education amid the pandemic: A bibliometric and content analysis. *The International Journal of Management Education*, *21*(2), 100796. <https://doi.org/10.1016/j.ijme.2023.100796>
- Pyrchenkova, G., & Radchenko, E. (2021). Experience of emergency organization of distance learning for police managers. *SHS Web of Conferences*, *97*, 01037. <https://doi.org/10.1051/shsconf/20219701037>
- Ramlatchan, M. (2019). *Multimedia learning theory and instructional message design*. Retrieved from Old Dominion University Digital Commons: https://digitalcommons.odu.edu/efl_fac_pubs/1
- Riffe, D., Lacy, S., Watson, B. R., & Lovejoy, J. (2023). *Analyzing media messages: Using quantitative content analysis in research* (5th ed.). Routledge. <https://doi.org/10.4324/9781003288428>
- Spridzans, M. (2024). Challenges of digital education development at law enforcement training institutions. In *Society. Integration. Education. Proceedings of the International Scientific Conference* (Vol. 1, pp. 239–244). <https://doi.org/10.17770/sie2024vol1.7905>
- Yang, Z. (2024). Innovation and practice of public security police training curriculum and education system in the age of information technology, with police professional competence as the core. *Applied Mathematics and Nonlinear Sciences*, 9(1), 1-15. <https://doi.org/10.2478/amns.2023.2.01443>

About the Author(s).



Ahmed Mohammed Alkhalifi is a Senior Multimedia Design Specialist at Dubai Police, with more than 15 years of professional experience in visual design, branding, and instructional technology. He is a PhD candidate in Multimedia from Universiti Utara Malaysia, where his research focused on the determinants influencing instructional designers' implementation of multimedia learning principles in law enforcement e-learning contexts. His research interests include instructional design, multimedia learning, e-learning systems, and corporate branding.



Nurulhuda Binti Ibrahim is with the School of Multimedia Technology and Communication, Universiti Utara Malaysia. Her research focuses on Human–Computer Interaction, persuasive design, and games. Current projects include persuasive digital storytelling, multimedia learning, and mobile game-based learning.



Sobihatun Nur Abdul Salam is an Associate Professor at the School of Multimedia Technology and Communication, Universiti Utara Malaysia. Her research interests include persuasive multimedia, multimedia design, assistive technology, and gamification. She has published widely and led numerous grants, with recent projects focusing on multimedia learning, persuasive technology, and mobile applications for education.