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The Conceptual Dimensions, Practical Challenges, and Developmental Pathways of AI Literacy for Police Cadets

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Abstract: In response to the growing demands placed on law enforcement personnel by the transformation toward intelligent policing, this study proposes a conceptual framework of artificial intelligence (AI) literacy for Police cadets, encompassing three interrelated dimensions: technological understanding, data-driven thinking, and value-based ethics. At present, police education faces several structural challenges, including a pronounced instrumental orientation toward technology, a disconnect between general education and professional training, and a lack of contextualized learning environments. To address these issues, this study advances a set of developmental pathways, including the construction of interdisciplinary integrated curricula, the adoption of inquiry-based learning grounded in authentic policing cases, and the establishment of mechanisms that promote the internalization of ethical norms through collaboration between police academies and operational units. By reshaping educational models, the study seeks to enhance the professional adaptability of future law enforcement officers and strengthen the legitimacy of policing practices in the digital era.

Keywords: Police cadets; Artificial intelligence literacy; Smart policing

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1. Introduction

With the rapid diffusion of artificial intelligence technologies, policing practices worldwide are undergoing a profound digital transformation [1]. From predictive policing and automated surveillance to data-driven crime analysis, intelligent technologies are no longer merely auxiliary tools but are increasingly embedded at the core of contemporary law enforcement systems [2]. This shift toward "smart policing" has fundamentally reshaped traditional policing ecosystems, requiring police organizations to move away from experience-based and intuition-driven modes of operation toward models grounded in data analytics and algorithm-assisted decision-making. Within this context, the competency profile of police officers has changed substantially, with technological adaptability and data literacy emerging as key indicators of professional capability [3]. Whether in addressing increasingly sophisticated cybercrime or conducting routine patrols supported by intelligent

terminals, the effective use of AI technologies has become directly linked to policing efficiency and public safety outcomes [4].

Despite the rapid evolution of policing technologies, police higher education and vocational training systems have often lagged behind. Existing police academy curricula continue to prioritize legal knowledge and physical or tactical training, while courses related to emerging technologies are frequently marginalized or confined to basic operational instruction. Deeper engagement with algorithmic reasoning and technological ethics remains limited. For police cadets—students who will soon become frontline law enforcement actors—this "skills gap" not only constrains their ability to adapt to future policing environments but also increases the risk of data misuse or ethical violations in the application of AI-enabled tools. Accordingly, clarifying the conceptual structure of AI literacy for police cadets, examining the gaps within current educational practices, and exploring effective developmental pathways are of both theoretical significance and practical importance for bridging the divide between education and real-world policing and for cultivating law enforcement personnel suited to the intelligent era.

2. The Conceptual framework and multidimensional structure of AI literacy for police cadets

2.1. Foundational dimension: Technological understanding and operational competence

At the foundational level, AI literacy for police cadets addresses the need for cognitive and operational adaptation as intelligent technologies become deeply embedded in policing practice. Importantly, technological understanding in this context does not require mastery of complex programming or algorithm design. Rather, it emphasizes a functional grasp of how AI systems operate—specifically, their reliance on data for analysis and prediction—as well as an informed awareness of their applicable scope and inherent limitations. Such understanding enables police cadets to adopt a balanced view of AI in policing, avoiding both uncritical reliance and instinctive rejection [5].

Operational competence, by contrast, focuses on practical execution within smart policing contexts. As mobile policing terminals, intelligent sensing devices, and digital information systems become standard tools in frontline work, police cadets must be able to use these technologies in a standardized and effective manner [6]. This requires not only technical proficiency but also the capacity to deploy technological tools appropriately under complex or high-pressure conditions for tasks such as information collection, data entry, and preliminary analysis. The core function of this foundational dimension lies in fostering coordination between technological tools and policing actions, ensuring that technology enhances, rather than burdens, law enforcement practice.

2.2. Core dimension: Data-driven policing mindset and intelligence analysis capacity

Building on basic technological competence, the core dimension centers on the understanding and application of data-driven policing models. A data-oriented mindset requires Police cadets to move beyond case-by-case thinking and adopt a more holistic and relational perspective on public security issues. In highly interconnected information environments, critical clues are often dispersed across multiple systems and contexts. Police cadets must therefore develop the ability to identify patterns, correlations, and trends across diverse data sources and to treat analytical outcomes as key inputs for decision-making.

Within this framework, intelligence analysis capacity refers to the ability to critically interpret and apply outputs generated by technological systems. Although intelligent systems can produce risk alerts or predictive

insights through algorithmic modeling, such outputs remain probabilistic in nature and cannot replace professional judgment. Police cadets must be capable of integrating analytical results with policing experience and contextual knowledge, verifying system-generated conclusions through situational assessment. Only through effective human–technology collaboration can data analysis be transformed into actionable intelligence with practical policing value.

2.3. Value dimension: Algorithmic ethics, privacy protection, and rule-of-law awareness

As AI technologies significantly enhance policing capacity for perception and analysis, the regulation of technological boundaries becomes a foundational requirement of AI literacy. While intelligent systems can improve efficiency, they may also produce unjust outcomes due to biased data or improper use [7]. Police cadets must recognize that some technologies may inadvertently reinforce existing social inequalities, necessitating cautious application and resistance to simplistic or stigmatizing judgments of specific groups. In contexts involving personal data collection and processing, adherence to proportionality and minimization principles is essential to reduce unnecessary intrusion into individual privacy.

Beyond ethical awareness, this dimension also encompasses a strong commitment to the rule of law. Whether in data acquisition, system access, or evidentiary use, technological tools must operate strictly within legal and procedural frameworks. Police cadets must clearly understand that AI systems serve only as auxiliary instruments and that responsibility for law enforcement decisions ultimately rests with human actors. Strengthening this value-based orientation helps future officers balance efficiency with procedural integrity, safeguarding public trust in policing institutions.

3. Practical challenges in cultivating AI literacy among police cadets

3.1. Lagging educational philosophy: Emphasis on technical application over cognitive development

An examination of current curricula and teaching practices in police academies reveals a persistent emphasis on technological application, with insufficient attention to the cultivation of underlying cognitive structures. As previously noted, the essence of data-driven policing lies not in tool proficiency but in the ability to reason and decide based on data. However, AI education is frequently framed as a set of ready-to-use tools, with instructional objectives focused on operational procedures rather than conceptual understanding of technological logic and limitations.

This tendency manifests in curricula that prioritize software interfaces, coding demonstrations, or equipment manuals, while neglecting discussion of data reliability, analytical uncertainty, and the implications of technological intervention in decision-making. Consequently, students may acquire operational skills without understanding why systems generate particular outputs or under what conditions those outputs may fail. More critically, a tool-centered philosophy risks diminishing students' awareness of their role as accountable decision-makers. When AI literacy is equated with technological upgrades alone, the centrality of human judgment and responsibility in policing is obscured, leaving Police cadets ill-prepared for complex or anomalous scenarios.

3.2. Fragmented curriculum structures: Disconnection between general education and policing practice

Beyond educational philosophy, structural fragmentation within curricula poses another major obstacle. In

many police academies, technology-related courses and professional policing courses are housed in separate instructional units, with limited coordination in content or objectives. This separation reduces the likelihood that technological knowledge will be effectively translated into policing practice.

Typically, AI or computing courses are delivered as general education modules emphasizing universal concepts and operations, with minimal reference to policing contexts. As a result, students struggle to relate what they learn to real policing problems. Conversely, professional policing courses may acknowledge the importance of informatization but often address technology only at a conceptual level, without exploring underlying principles or application conditions. In the absence of bridging courses, students are left to independently integrate technical knowledge with operational demands, leading to fragmented learning and weakened educational outcomes.

3.3. Homogeneous teaching methods: Lack of immersive and contextualized learning environments

In terms of pedagogy, AI-related instruction continues to rely heavily on lectures and static demonstrations, which inadequately reflect the complexity of real policing environments. Compared with operational realities, classroom learning often presents simplified scenarios with controlled variables, offering limited exposure to uncertainty and dynamic change.

In practice, policing data are frequently incomplete, noisy, or erroneous, and analytical outputs require careful contextual interpretation. However, current teaching environments rarely allow students to experience challenges such as data validation, error correction, or integrated judgment. Moreover, the limited tolerance for error in real policing contrasts sharply with the absence of low-risk trial-and-error opportunities in education. Without high-fidelity simulations, students lack opportunities to experiment, reflect, and refine their judgment, constraining the development of comprehensive decision-making and normative awareness.

3.4. Insufficient faculty capacity: Absence of interdisciplinary teaching teams

Effective AI literacy education depends on interdisciplinary teaching capacity, yet police academies often face shortages in this area. Technical instructors typically possess strong technological expertise but limited familiarity with policing processes, while practitioners with operational experience may lack systematic knowledge of AI principles and mechanisms.

In the absence of stable collaboration mechanisms, these two groups often teach independently, hindering integrated curriculum design and joint instruction. This fragmentation weakens the relevance and coherence of teaching content and limits alignment with practical policing needs. Additionally, given the rapid evolution of intelligent policing technologies, instructors who lack exposure to frontline applications may struggle to keep their knowledge current, further constraining the depth and quality of AI literacy education.

4. Optimizing developmental pathways for AI Literacy among police cadets

4.1. Reconstructing the curriculum: toward an integrated “AI + policing” framework

To overcome the disconnect between technology education and policing practice, systematic curriculum reconstruction is required. Rather than merely adding technical courses, AI content should be embedded within professional policing courses, allowing technology to function as an internal analytical resource rather than an external supplement.

For example, data processing and information analysis modules can be incorporated into core subjects such as criminal investigation or public order management, enabling students to understand technological functions within concrete policing contexts. This approach allows technical logic and operational logic to converge organically. Furthermore, curricula should adopt a tiered structure aligned with developmental stages and career orientations: foundational courses emphasizing general understanding, intermediate courses focusing on scenario-based application, and advanced modules addressing system optimization and strategic design. Modular and updateable course structures can also enhance adaptability to technological change.

4.2. Innovating pedagogy: Case-based and practice-oriented teaching

Pedagogical reform is essential for meaningful AI literacy development. Problem- and case-based learning grounded in authentic or highly realistic policing scenarios can facilitate a deeper understanding of technology through practice. Where feasible, virtual simulation technologies can be employed to create dynamic environments incorporating multi-source data and evolving conditions, enabling students to engage in information collection, analysis, and decision-making processes.

Assessment in such contexts should prioritize reasoning processes rather than final outcomes. By reviewing students' analytical paths and decision rationales, instructors can guide reflection on judgment criteria and potential biases in technology use. This reflective orientation supports the transformation of experiential learning into stable cognitive competence.

4.3. Strengthening ethical education: Integrating ethics and rule-of-law principles into skill training

Ethical and legal education must be integrated into AI skill development rather than treated as a supplementary component. Instruction in specific technologies should be accompanied by discussion of rights boundaries and legal risks, fostering normative awareness from the outset. Emphasizing human responsibility in decision-making helps prevent blind reliance on algorithmic outputs and sustains critical judgment.

Equally important is clarifying the relationship between efficiency and procedural integrity. While technology can enhance operational effectiveness, adherence to legality and fairness constitutes a non-negotiable baseline. Embedding these principles into technical training enables Police cadets to balance performance and compliance in future practice.

4.4. Building collaborative mechanisms: Deepening academy–agency partnerships

The cultivation of AI literacy extends beyond the academy and requires collaboration with operational policing units. Strengthening academy–agency partnerships can bridge gaps between education and practice, providing practical input for curriculum design and instructional updating.

Joint teaching models involving academic instructors and practitioners can enhance relevance and coherence, while shared access to anonymized real-world cases and datasets can enrich learning materials. Feedback mechanisms that incorporate operational perspectives into training evaluation further ensure alignment between educational objectives and policing realities, ultimately improving the effectiveness of AI literacy development.

5. Conclusion

Integrating AI literacy into police education represents not merely a technological upgrade but a critical evolution in the professionalization of law enforcement in the digital era. This study argues that the cultivation of police cadets must move beyond isolated skill training toward a holistic model that intertwines data fluency, critical thinking, and ethical reasoning. By restructuring curricula to bridge academic instruction and operational reality, police academies can prepare officers capable of navigating the complexities of data-driven policing. Ultimately, the development of multidimensional AI literacy is essential not only for enhancing policing efficiency but also for sustaining the legitimacy of law enforcement by ensuring that technological advancement proceeds alongside the protection of citizens' rights and the mitigation of algorithmic risks.

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