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Metacognitive foundations for designing a programme for the targeted development of professional thinking in future border guard officers

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✦ **Abstract.** Metacognitive regulation is a psychological resource underpinning the effectiveness of the professional thinking of border guard officers, whose work is carried out under conditions of uncertainty, considerable psychological strain, and time pressure. At the same time, the gap between the development of metacognitive theory and its systematic application to the conceptualisation of existing professional thinking development programmes constitutes a significant theoretical scientific problem. The aim of this article was to substantiate the metacognitive foundations for designing a programme for the targeted development of professional thinking in future border guard officers through a theoretical analysis of its structural and functional components in the light of contemporary concepts of metacognition. The research methods employed included theoretical analysis and synthesis, comparative analysis, and conceptual modelling; the analytical framework was based on the metacognitive triad of "metacognitive knowledge – metacognitive monitoring – metacognitive control". The programme's three-block structure (theoretical, practical-developmental, and emotional-reflective blocks) is functionally aligned with the components of the metacognitive triad, while the temporal sequencing of the blocks corresponds to the psychological logic of metacognitive regulation development across three stages of professional training. The system of educational and professional tasks of four types (procedural, communicative, practical, and problem-based) implements the principle of metacognitively supported learning; six psychological conditions for activating metacognitive regulation have been identified, forming a causal pathway within the programme's implementation process. Six metacognitive foundations for programme design have been formulated, and the MERIDIAN metacognitive matrix for the targeted development of professional thinking in future border guard officers has been constructed. This matrix operationalises the identified metacognitive architecture through parameter-based dimensions and developmental stages. The MERIDIAN matrix is intended as a design tool for lecturers teaching professional-cycle disciplines in higher military educational institutions. The findings are applicable to the design of professional thinking development programmes in higher military educational institutions of other security and law-enforcement agencies

✦ **Keywords:** supported learning; self-regulation of thinking; psychological conditions; reflective closure; MERIDIAN matrix

✦ Introduction

The ability to be aware of one's own thinking processes, to regulate their course in a purposeful manner and to evaluate the results – namely, metacognitive regulation – is becoming increasingly important in the context of training specialists whose work takes place in extreme conditions. In contemporary theoretical frameworks, notably those of D. Kuhn (2022), metacognitive regulation has been interpreted as a key mechanism for the flexible and adaptive functioning of the individual in complex situations, as it is precisely this that enables the monitoring of cognitive effectiveness and the timely adjustment of problem-solving strategies. An empirical study by C. Reale *et al.* (2023)

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confirmed that metacognitive processes play a decisive role in decision-making in dynamic and dangerous environments, where the outcome depends on the individual's ability to recognise their own cognitive biases and regulate them in real time. In law enforcement, security and military contexts, professional thinking unfolds under conditions of high stress, time pressure and complex cognitive load. As noted by N.M. Sekel *et al.* (2023), in a military environment, adaptive tactical decision-making under simulated operational stress depends on the personal characteristics, resilience, aerobic fitness and neurocognitive functions of military personnel. In a military environment, self-regulation was considered by M.J.W. McLarnon *et al.* (2021) and R. Zueger *et al.* (2023) as a factor in personnel resilience to the impact of adverse conditions, whilst resilience training programmes for cadet officers are being studied as a resource for reducing the psycho-emotional and physical stress effects of training. Future border guard officers belong to the same professional category, as their operational and service activities unfold in conditions of uncertainty, significant psychological strain and time constraints.

At the same time, in psychological science, there remains a persistent gap between the development of metacognitive theory and its systematic implementation in specialist training programmes, as emphasised by J.L. Dennis & M.P. Somerville (2023). At the level of professional development for higher education lecturers, this gap manifests as a lack of conceptual tools that would enable to interpret the existing curriculum in its metacognitive terms and consciously design the metacognitive architecture of the teaching interaction (Fono & Zohar, 2024). This gap is also particularly evident in the training of future officers of security and law enforcement agencies, where the metacognitive potential of the curriculum is not systematically conceptualised in psychological terms. Among Ukrainian studies, a verified programme for the targeted development of professional thinking in future border guard officers was developed in the doctoral research by A. Fedyk (2021), which serves as the primary source for this analysis. The programme is based on the conceptual principles of problem-based learning and has been validated in a formative experiment; however, metacognitive terminology was not articulated within it. This created a methodological opportunity for the theoretical reconstruction of its implicit metacognitive architecture within the categories of contemporary metacognitive psychology. n recent systematic reviews, including the work by C. Reale *et al.* (2023), decision-making in high-risk environments identifies metacognitive processes as a key resource for a specialist's effectiveness under conditions of uncertainty and time pressure-conditions that closely correspond to the operational and service activities of border guard officers. However, even in this field, metacognitive expertise is described primarily at the level of the expert's individual characteristics and rarely translates into a design principle for the development of professional training programmes. This has demonstrated that the theory-practice gap concerns not only higher education in general, but also precisely those fields which, by the nature of their activities, are most in need of metacognitive conceptualisation.

The existing contradiction between the extensive development of metacognitive theory and the absence of its systematic application to the conceptualisation of a verified programme for the targeted development of professional thinking in future border guard officers constitutes a significant theoretical research problem. Addressing this problem requires a theoretical analysis of the programme's structural and functional components through the lens of contemporary metacognitive concepts, the identification of its implicit metacognitive architecture, and the substantiation of the psychological conditions that facilitate the activation of metacognitive regulation during its implementation. The aim of the study was to provide a theoretical justification for the metacognitive foundations underpinning the design of a programme for the development of professional thinking in future border guard officers through an analysis of its structural and functional components. Achieving this aim involved the following objectives: to conduct a theoretical analysis of the concept of metacognition in the context of developing the professional thinking of future border guard officers; to reveal the metacognitive potential of the programme's structural blocks (theoretical, practical-developmental, and emotional-reflective) and to substantiate the mechanism of metacognitively supported learning through a system of four task types; and to formulate the metacognitive foundations of programme design and develop a metacognitive matrix for the targeted development of professional thinking in future border guard officers as a tool for their operationalisation.

✦ Materials and Methods

The study was conducted within the framework of theoretical analysis. Its source base consisted of scholarly publications in metacognitive psychology and the psychology of professional thinking, including the works of A. Efklides (2011) and C. Dignath & M.V.J. Veenman (2021). The verified programme for the targeted development of professional thinking in future border guard officers developed by A. Fedyk (2021) served as the primary source for the analysis. Publications were selected according to criteria of thematic and conceptual relevance to the subject of investigation and bibliographic verifiability. The central object of analysis was the three-block structure of the programme, consisting of theoretical, developmental, and emotional-reflective blocks. The second block, designated by A. Fedyk (2021) as the developmental block, is referred to in the present article as the practical-developmental block to reflect its functional orientation towards the active solution of educational and professional tasks. The absence of explicit metacognitive conceptualisation in the original source was verified through an analysis of its content and bibliography for metacognitive terminology and relevant theoretical references. On this basis, the reconstruction of the

programme's metacognitive architecture is regarded as the author's own interpretation.

The interpretative framework adopted for the analysis was the triad "metacognitive knowledge – metacognitive monitoring – metacognitive control", derived from the classic works of the founders of metacognitive psychology, J.H. Flavell (1979) and A.L. Brown (1987), as well as the later operational models proposed by T.O. Nelson & L. Narens (1990). This triad was selected because of its suitability for describing the structural and functional components of an educational-developmental programme and its compatibility with the content of the source under examination. The research was conducted using interrelated theoretical methods. Theoretical analysis and synthesis were applied to examine key concepts of metacognition and distinguish them from related concepts in cognitive and regulatory psychology. Comparative analysis was used to compare the three blocks of the author's programme with functional descriptions of metacognitive processes in the scientific literature; the functional characteristics of each block served as the unit of comparison, and the comparison was carried out according to the logic of correspondence between the programme's components and the elements of the analytical triad. A similar comparison procedure was applied to the system of tasks across four levels of complexity as a tool for implementing the mechanism of metacognitive supportive learning within the programme. Conceptual modelling enabled the construction of a coherent theoretical framework of the programme's metacognitive architecture by correlating its blocks with the components of the triad. Systematisation and generalisation were applied to formulate the psychological conditions for activating metacognitive regulation during the programme's implementation and to outline prospects for its improvement on a metacognitive basis.

The research logic comprised three consecutive stages. The first stage involved a theoretical examination of the concept of "metacognition" in the context of the development of professional thinking; at this stage, the conceptual framework of the article was established. The second stage involved a comparative analysis of the three-block structure of the author's programme through the prism of the analytical triad; at this stage, substantive correspondences were established between the programme blocks and the components of the triad. The third stage involves conceptual modelling of the programme's metacognitive architecture, including the formulation of psychological conditions for activating metacognitive regulation and prospects for its improvement.

✦ Results and Discussion

A theoretical analysis of the concept of "metacognition" in the context of the development of professional thinking

The concept of "metacognition" entered scientific discourse in the late 1970s following the publication of J.H. Flavell (1979), in which the author defined metacognition as knowledge and understanding of cognitive phenomena, with an emphasis on the function of self-regulatory monitoring of one's own thinking during problem-solving. Further development of the concept unfolded along two lines: cognitive-developmental and regulatory. In A.L. Brown (1987), metacognition is presented as a system of executive control over cognitive activity, with an emphasis on mechanisms of self-regulation and the transfer of strategies to new contexts. In parallel, T.O. Nelson & L. Narens (1990) proposed an operational model of metacognition in which the meta-level and the object level are in a two-way relationship: the meta-level monitors the object level, whilst the object level is restructured by the meta-level through a control function. This model remains fundamental in most contemporary applied uses of metacognition. In subsequent theoretical generalisations, the structure of metacognition has stabilised around two components: metacognitive knowledge and metacognitive regulation. Metacognitive knowledge, according to the classification by G. Schraw & D. Moshman (1994), encompasses declarative knowledge about oneself as a subject of cognition, procedural knowledge about thinking strategies, and conditional knowledge about the appropriateness of applying strategies in specific situations. Metacognitive regulation encompasses planning, monitoring, evaluation, correction and information management of cognitive activity. P.R. Pintrich (2002) clarified that metacognitive knowledge is a resource that can be developed through teaching and forms the basis of conscious learning alongside strategic knowledge. The current stage of the concept's development is characterised by the integration of metacognition with affective-motivational factors of self-regulation. In A. Efklides' (2011) model of metacognition and affective self-regulation, metacognitive processes are in constant interaction with the motivational and emotional spheres: affective states directly influence the accuracy of monitoring, confidence in decision-making, and readiness to adjust the chosen strategy. Metacognition, self-regulation and self-regulated learning are viewed as a shared theoretical space with distinct emphases. G. Schraw & R.S. Dennison (1994) and D. Kuhn (2022) have noted a steady expansion of the empirical applications of metacognitive models, whilst the gap between theory and applied practice in higher education remains.

In the Ukrainian psychological tradition, metacognitive issues are explored in close connection with the concept of subjectivity and the psychological mechanisms of learning. N.I. Poviakel (2004) defined the self-regulation of professional thinking as a systemic property of a specialist, encompassing metacognitive awareness, a culture of self-organisation and self-mobilisation. M.L. Smulson (2014; 2022), in line with Y.I. Mashbyts (n.d.), demonstrated that the psychological mechanisms of learning – namely, the dynamic distribution of control functions, feedback, and the redefinition of learning tasks – functionally implement precisely those operations that are designated as monitoring and control in contemporary metacognitive models. In the works of Y.I. Mashbyts (n.d.), these mechanisms are described as a

tool for purposeful management of learning activities with a gradual transfer of control functions from the teacher to the learner (Fedyuk, 2020). The concept of metacognition is relevant to the development of professional thinking in future border guard officers for three reasons. Firstly, the operational and service activities of a border guard officer unfold as the resolution of problem-solving tasks under conditions of uncertainty, significant psychological stress and time constraints, and it is precisely in such conditions that metacognitive regulation has the strongest effect on the effectiveness of thinking (Flavell, 1979; Fedyk, 2021). Secondly, professional thinking as a subject of targeted development involves not only the acquisition of mental operations, but also the development of the ability to manage them under psychological pressure, which structurally corresponds to the function of metacognitive control (Nelson & Narens, 1990; Efklides, 2011). Thirdly, the psychological mechanisms of learning underlying A. Fedyk's (2021) programme functionally coincide with the operational model of metacognition, making the metacognitive framework an adequate tool for conceptualising the programme within its own psychological categories, rather than an external theoretical imposition. The analysis carried out confirms the appropriateness of using the triad "metacognitive knowledge – metacognitive monitoring – metacognitive control" as an analytical framework for further consideration of the programme's architecture, the system of educational and professional tasks, and the psychological conditions for its implementation. In the course of the theoretical analysis of the structural and functional components of the author's programme for the development of professional thinking among future border guard officers, it was established that the three-block structure of the programme is substantively consistent with the functional components of metacognition, and the system of educational and professional tasks, which forms the core of the practical-developmental block, implements the principle of metacognitive supportive learning. A systematic justification of these propositions is presented below.

The metacognitive architecture of the programme's three modules

The theoretical module of the programme by A. Fedyk (2021) is, in terms of its functional content, aimed at forming in cadets a systematic understanding of the characteristics of professional thinking, the psychological mechanisms of problem-solving for a border guard officer, thinking strategies (analogising, combining, reconstructing) and the psychological conditions for regulating cognitive activity in the specific and extreme conditions of operational and service duties. The subject matter of the theoretical module aligns with the three types of metacognitive knowledge classically distinguished in contemporary metacognitive psychology: declarative (the cadet's knowledge of their own cognitive processes, and the strengths and weaknesses of their thinking), procedural (knowledge of methods and techniques for solving professional tasks) and conditional (knowledge of the operational situations and criteria under which a particular thinking strategy should be applied) (Schraw & Moshman, 1995; Pintrich, 2002). The theoretical component, accordingly, serves within the programme to establish the foundation of metacognitive knowledge, without which further practice in monitoring and control remains merely formal. The practical-developmental component of the programme is aimed at the active resolution of professionally oriented learning tasks and is implemented through three psychological mechanisms of learning according to Y.I. Mashbyts (n.d.): the mechanism of dynamic distribution of control functions in the "lecturer ↔ cadet" system, the feedback mechanism, and the mechanism of refining the learning task (Smulson, 2014; Fedyuk, 2020). The psychological content of each of these mechanisms corresponds directly to the functions of metacognition in the operational model of T.O. Nelson & L. Narens (1990): the meta-level monitors the object level, receives information about the course of cognitive activity and, through control, restructures this activity in the event of a discrepancy between intermediate results and expected ones. The mechanism of dynamic distribution of control functions implements a gradual transfer of control functions from the lecturer to the cadet, which, in metacognitive terms, signifies the internalisation of the control function. The feedback mechanism ensures the tracking of the success of cognitive actions, meaning it implements the monitoring function. The mechanism of redefining the learning task requires the cadet to independently reformulate the conditions and objectives, which directly activates metacognitive knowledge about the task and the appropriateness of applying relevant strategies (Flavell, 1979). The practical-developmental block thus unfolds the functional dynamics of metacognitive regulation in the activity-based dimension of professional thinking.

At the same time, the practical implementation of monitoring and control remains incomplete without affective-regulatory integration. It is precisely this function that is performed by the programme's emotional-reflective component, which ensures the consolidation of the metacognitive loop through its self-regulatory and affective components. In A. Efklides' (2011) model of metacognitive and affective self-regulation, metacognitive processes are in constant interaction with emotional states: affective experiences directly influence the accuracy of monitoring, confidence in the decision made, and readiness to correct it. In the operational context of a border guard officer's duties, where decisions are made under significant psychological pressure, affective-reflective regulation determines whether the individual can identify an error in their own thinking in time and adjust their strategy. A cadet's systematic engagement with their own experiences, evaluation of outcomes, and reflection on the chosen strategy reinforces monitoring and control as stable metacognitive skills, transforming them from episodic to systematic (Schraw & Moshman, 1995; Zimmerman, 2000). The emotional-reflective block provides a self-regulatory feedback loop,

without which metacognitive knowledge and the practice of monitoring do not coalesce into a coherent ability to regulate professional thinking. The temporal unfolding of metacognitive development within the programme deserves special attention. The metacognitive architecture, embedded in the three blocks, is implemented not as a one-off educational activity, but as systematic work over several academic years based on the phased development of professional thinking: at the initial stage, the cognitive component dominates; at the main stage, the operational component; and at the final stage, the personal component (Fedyk, 2021). Following this logic, the theoretical module is activated primarily in the early stages of training and lays the foundations for metacognitive knowledge; the practical-developmental module unfolds in the main stage through a system of tasks of increasing complexity, whilst the emotional-reflective block achieves full effectiveness at the final stage, when the cadet is capable of sustained self-regulation of professional thinking. Empirical testing of the programme within a formative experiment (2016-2017), followed by the recording of the dynamics of professional thinking development (2017-2018), confirmed the appropriateness of precisely this extended implementation, which is substantively consistent with the meta-analytical data of C. Dignath & M.V.J. Veenman (2021) indicating that metacognitive skills become stable only through systematic training over a sufficient period of time. A comparison of the programme's three blocks with the functional components of metacognition and the phased logic of its development shows that the three-block structure ensures the sequential development of metacognitive regulation: from knowledge about thinking (theoretical block, initial stage) to the monitoring and control of cognitive actions (practical-developmental block, main stage) and further to self-regulatory consolidation through reflection and the affective loop (emotional-reflective block, final stage). The identified correspondence is a theoretical outcome of this analysis and is consistent with contemporary findings that the effectiveness of thinking development programmes in higher education increases provided there is a holistic activation of all components of metacognition.

Four types of educational and professional tasks and the mechanism of metacognitive supportive learning

The established metacognitive architecture of the three blocks is implemented substantively through a system of educational and professional tasks, which forms the core of the practical-developmental block and requires separate analysis. In A. Fedyk (2021), this system is identified based on the results of a psychological analysis of the operational and service activities of the State Border Guard Service of Ukraine and the regulatory framework, and comprises four types: procedural, communicative, practical and problem-based (non-standard) tasks. The rationale for this classification lies in the fact that each task type activates a distinct configuration of cognitive operations and strategies and, consequently, develops professional thinking from a different functional perspective. These task types are organised according to increasing levels of uncertainty and the degree of cadet autonomy in selecting solution strategies. From a psychological standpoint, this arrangement corresponds to the principle of metacognitively supported learning, namely the purposeful and gradual reduction of external support provided by the lecturer as the learner's metacognitive independence increases (Guo, 2022; Shao *et al.*, 2023). Procedural tasks involve the performance of algorithmised operational actions in accordance with clearly regulated legal and regulatory documents – the procedure for border control at a checkpoint, the sequence of personal and document identification, and the algorithm of actions for border guards on the border line. The psychological structure of a procedural task consists of a simulated initial state, a simulated final state, and the procedure for transitioning between them (Fedyk, 2021). At this level, external support is maximal: the task structure, performance guidelines, and criteria for correctness are externally defined. The lecturer's role is to demonstrate the algorithm, explain it step by step, and monitor the accuracy of execution in real time through a feedback mechanism; the cadet's role is to recognise the type of task, select the appropriate algorithm from the available repertoire, and reproduce it accurately. The metacognitive load on the student is focused on activating declarative and procedural metacognitive knowledge (knowledge of algorithms and the conditions for their application), whilst the functions of monitoring and control are primarily carried out by the lecturer. The developmental effect of procedural tasks lies in the formation of a repertoire of automated professional actions, without which it is impossible to free up cognitive resources for solving more complex tasks.

Communicative tasks shift the emphasis towards interpersonal interaction within systems such as "officer-subordinate", "officer-offender", "officer-representative of a cooperating agency", and "officer-citizen undergoing border control". These tasks require the regulation of one's speech and behaviour in accordance with the dynamics of the situation. The distinctive feature of a communicative task is that the object of influence is an active system represented by another person whose knowledge state and reactions change throughout the interaction process (Fedyk, 2021). The lecturer's role consists of modelling the communicative situation, providing the role-playing framework, and analysing the consequences of the communication strategies employed once the exercise has concluded. The cadet's role is to monitor the interlocutor's responses continuously, adjust their own communicative behaviour, and anticipate the development of the dialogue. Metacognitive demands increase through the need for ongoing monitoring of the communicative process and the real-time adjustment of one's strategy. At this stage, the cadet begins to assume part of the monitoring function, while the lecturer retains the control function through final evaluation. The developmental value of communicative tasks lies in fostering skills of interpersonal regulation of professional thinking, which

are critically important in negotiations with offenders, interactions with foreign nationals at border crossing points, and the coordination of actions within operational units. Practical tasks simulate real-life operational situations with incomplete initial data – guarding a section of the border under resource-constrained conditions, the deployment of a unit's forces and resources, and responding to signals from technical surveillance equipment – and require the combined application of knowledge, skills and cognitive strategies. Unlike procedural tasks, where the solution path is dictated by an algorithm, and communicative tasks, where the subject of influence is fluid, practical tasks require cadets to independently choose a strategy from several plausible options, taking into account the specific conditions of the situation. The role of the lecturer is limited to providing a framework as a facilitator: setting the task, providing initial data and advisory assistance at critical points in the solution; the cadet's role is to independently analyse the conditions, select a strategy, make interim decisions and assess their consequences. The metacognitive load increases significantly: the cadet independently monitors interim results and makes control decisions within the given problem framework. The developmental effect of practical tasks lies in the formation of the ability to self-regulate the solving of professional tasks within a known problem domain.

Problem-based (non-standard) tasks place cadets with situations in which known algorithms do not provide a solution, and the conditions of the task require further clarification – such as an atypical attempt to breach the border, a sudden change in the operational situation within the area of responsibility, or the unpredictable behaviour of individuals at a border crossing point. It is at this level that the mechanism for further defining the training task is activated, requiring independent reconstruction of the problem, the formulation of working hypotheses and an assessment of their adequacy (Fedyuk, 2020). The lecturer's role is limited to advisory interaction – posing the problem and being ready to discuss the strategies chosen by the cadet; the cadet's role is to independently formulate the problem, generate alternative solutions, critically evaluate them, and select the optimal option. The functions of monitoring and control are entirely transferred to the student, with external support reduced to a minimum. It is in problem-based tasks that metacognitive regulation is realised in its fullest form, which is consistent with J.H. Flavell's (1979) assertion regarding the strongest activation of metacognitive processes in situations that exceed existing automated action schemes. The developmental effect of problem-solving tasks lies in the formation of the ability – crucial for a border guard officer – to make decisions under conditions of uncertainty and time pressure. The correlation of the four types of tasks with the metacognitive triad demonstrates that the task system encompasses a full cycle of metacognitive supportive learning: from activities with maximum external guidance (procedural tasks) through a gradual shift of monitoring towards the cadet (communicative and practical tasks) to full internal monitoring and control (problem-solving tasks). The proposed interpretation is based on three factors:

a) the content-based characterisation of the task types themselves in the original source, which reflects the principle of reducing external support;

b) the psychological mechanisms of learning according to Y.I. Mashbyts (n.d.), which are functionally identical to monitoring and control in the model by T.O. Nelson & L. Narens (1990);

c) meta-analytical data from L. Guo (2022), C. Dignath & M.V.J. Veenman (2021) and A.A. Khachadoorian *et al.* (2020) indicating that structured support and metacognitive cues significantly enhance the quality of self-regulated learning in applied educational settings, particularly in the context of professional military education.

The identified metacognitive nature of the classification leads to a practical generalisation that extends beyond the programme's primary scope of application. The proposed framework is invariant with respect to the subject content of the discipline and can be adapted by a lecturer of any academic discipline within a higher military educational institution by organising the existing teaching material into four types of tasks and ensuring a gradual transition between them (Fedyk, 2021). Such adaptation creates the conditions for the systematic development of professional thinking in various areas of professional training – not only within the State Border Guard Service system, but also in higher military educational institutions of other law enforcement agencies in Ukraine, where similar types of operational tasks are present. The universality of the metacognitive framework, particularly in this applied context, determines its value as a tool for designing programmes to develop professional thinking among specialists in law enforcement and security agencies.

Psychological conditions for enhancing metacognitive regulation

The implementation of a system of educational and professional tasks as a mechanism for metacognitive supportive learning depends on the psychological conditions under which the educational interaction takes place. The original source identifies six interdependent psychological conditions for the development of professional thinking in future border guard officers, each of which manifests a specific metacognitive function and requires the lecturer to perform a specific set of actions at the level of behaviour, speech and organisation of the environment (Fedyk, 2021). The first condition – establishing subject-subject interaction within the "lecturer ↔ learners" system whilst the lecturer models professionally oriented problem-solving tasks – creates a safe psychological space of non-judgemental acceptance. The lecturer maintains this environment through specific behavioural actions: speaking at a calm pace with a warm and supportive tone; avoiding abrupt increases in volume and directive language; using open gestures with hands positioned at chest level; maintaining direct yet non-judgemental eye contact; sitting at

the same level as the cadet or beside rather than opposite them; allowing a pause after the cadet's response before reacting; verbalising their own reasoning as an example of metacognitive reflection; and replacing direct correction with clarifying questions such as, "What exactly did you do?", "Why did you choose this approach?", and "What concerns you about this solution?". From a metacognitive perspective, this condition facilitates the externalisation of thinking processes, without which metacognitive knowledge of oneself as a subject of professional thinking cannot be developed (Efklides, 2011; Veenman *et al.,* 2012).

The second condition – encouraging cadets to solve problems independently based on problem-based learning theory – involves a gradual reduction in external metacognitive support. The lecturer models a problem situation and then physically steps back: takes a step away from the cadet, moves to a side position in the lecture theatre, maintains a prolonged pause of silence even when the cadet has taken a wrong step, does not provide a ready-made answer to the cadet's question, but instead turns the question back using the phrase "And how do you see it?", uses open-ended questions rather than instructions, and does not intervene in small-group discussions during the first few minutes. In the metacognitive dimension, this condition involves the transfer of monitoring and control functions from the lecturer to the cadet, which corresponds to the key principle of metacognitive supportive learning (Guo, 2022; Shao *et al.*, 2023). The third condition – the development of indirect learning, personal prestige and professional-cognitive motives and interests, taking into account age, gender and individual cognitive characteristics – provides motivational reinforcement for metacognitive regulation. The lecturer implements this condition through specific actions: structuring each learning task as a fragment of the future professional activity of a border guard officer, referencing a specific operational situation (guarding a section of the border, a checkpoint, responding to a danger signal), invites practising officers with experience in operational service to individual sessions, uses video footage of real-life service incidents, gives cadets the opportunity to choose tasks from two or three options of the same level of difficulty, includes role assignments (supervisor, subordinate, representative of a related service), differentiates the complexity of tasks for groups with different starting levels, creates situations of early success for cadets with low motivation. The motivational sphere in A. Efklides' model (2011) is a direct determinant of the quality of metacognitive processes, in particular the accuracy of monitoring and readiness to adjust strategy (Efklides, 2011).

The fourth condition – directing cadets' attention towards understanding a task through conscious awareness and analysis of its conditions and requirements – activates metacognitive monitoring during the orientation phase. The lecturer signals the beginning of this phase through a range of techniques: emphasising key elements of the task by raising vocal stress on critical words; introducing meaningful pauses before key concepts and immediately after presenting the task; using a "stop" gesture or an open raised palm; writing the task conditions on the board while highlighting in colour what is known and what must be determined; displaying the task through a projector with its structural components clearly marked; using an auditory signal, such as a gong or bell, to indicate the beginning of the analytical phase; asking a sequence of questions such as "What is stated here?", "What exactly must be determined?", and "What constraints apply?"; and requiring the cadet to restate the task conditions in their own words before proceeding. This set of actions implements the mechanism of task elaboration and develops metacognitive knowledge about the task itself as a prerequisite for subsequent monitoring (Flavell, 1979; Pintrich, 2002).

The sixth condition – encouraging the sequential development of cadets' cognitive actions and operations during problem-solving – ensures the structured character of metacognitively supported learning. The lecturer implements this condition through the following actions: organises a 10-15-minute reflective session at the end of each lesson, conducts a reflection round with a sequence of fixed questions ("What did we do?", "What was the most difficult part?", "What would you do differently?", "What have you taken away from this as an officer?"), introduces a reflective journal with a fixed structure for entries after each session, records the solving of problem-based tasks on video and conducts a subsequent joint review with pauses at key decisions, asks the cadet to compare their own strategy in writing with a classmate's alternative, and assesses, together with the cadet, the alignment of the decision made with the professional values and regulatory requirements of the State Border Guard Service of Ukraine. This constitutes a full manifestation of metacognitive control with a reflective superstructure (Zimmerman, 2000; Stanton *et al.*, 2021). The six conditions form a single causal pathway for the activation of metacognitive regulation. The first condition creates a safe space for interaction, without which the remaining conditions lack the psychological foundation for implementation. On this basis, the second condition initiates the transfer of control from the lecturer to the cadet, whilst the third supports this transfer with a motivational resource. The fourth condition ensures a correct entry into the task through monitoring of the orientation phase, the fifth maintains monitoring and control throughout the entire problem-solving process as a consistent sequence, and the sixth closes the cycle with reflective evaluation and lays the foundation for the transfer of acquired strategies to subsequent tasks. The sequence "space – transfer – motivation – entry – process – closure" constitutes a coherent psychological architecture for activating metacognitive regulation within the programme.

Metacognitive principles for designing a programme to develop professional thinking

The analysis of the metacognitive architecture of the programme's three blocks, the system of four types of educational and professional tasks, and the psychological

conditions governing its implementation makes it possible to formulate the metacognitive foundations of designing a programme for the development of professional thinking in future border guard officers as an organised set of design principles that ensure the programme's metacognitive effectiveness within its own psychological categories. The first foundation is the integrity of the three-block metacognitive architecture. The programme is designed as a sequence of three functionally interdependent blocks in which the theoretical block establishes the foundation of metacognitive knowledge (declarative, procedural, and conditional), the practical-developmental block unfolds metacognitive monitoring and control within an activity-based context, and the emotional-reflective block completes the metacognitive cycle through self-regulatory reflection while taking into account affective and motivational factors. None of the blocks is optional: the omission of any one of them disrupts the integrity of metacognitive development and reduces the programme to a partial educational intervention (Schraw & Moshman, 1995; Efklides, 2011). The second foundation is the principle of the progressive reduction of external support through task typology. The system of educational and professional tasks is designed along a gradient of uncertainty and learner autonomy, progressing from procedural tasks with maximum external support, through communicative and practical tasks, to problem-based (non-standard) tasks with minimal support. This gradient implements the principle of metacognitively supported learning and ensures the controlled transfer of monitoring and control functions from lecturer to cadet throughout the three stages of professional training (Guo, 2022; Shao *et al.*, 2023).

The third foundation concerns psychological learning mechanisms as functional equivalents of metacognitive functions. The programme design incorporates the three psychological learning mechanisms identified by Y.I. Mashbyts: the mechanism of dynamic distribution of management functions, which facilitates the internalisation of control; the feedback mechanism, which performs the monitoring function; and the mechanism of task elaboration, which develops metacognitive knowledge about the task and activates strategic decision-making. These mechanisms are not added to the programme as external pedagogical techniques but constitute its internal operational foundation (Nelson & Narens, 1990; Fedyuk, 2020). The fourth foundation is the structured sequence of metacognitive operations within each problem-solving cycle. The solution of each of the four task types is designed according to a common seven-stage algorithm: analysis of conditions, evaluation of information, formulation of the task, generation of solution options, anticipation of intent, decision-making, and evaluation. This structure consolidates monitoring and control as stable operations performed in a consistent sequence and facilitates their transfer across different task types and academic disciplines (Dignath & Veenman, 2021). The fifth foundation is a psychologically safe subject–subject interaction space as the basis for metacognitive externalisation. Programme design requires the creation of a climate of non-judgemental acceptance through the lecturer's role as facilitator, researcher, observer, and partner in joint activity and communication. Without such a foundation, cadets do not engage in the verbalisation of their own thinking strategies, and metacognitive knowledge about oneself as a cognitive agent cannot develop (Efklides, 2011; Fedyk, 2021). The sixth foundation is reflective closure that incorporates the affective-motivational dimension. The programme design necessarily includes a reflective phase in which cadets' metacognitive gains are consolidated through systematic self-observation and critical evaluation of their own strategies, while taking into account the influence of emotional states on the quality of metacognitive judgements. It is this reflective closure that determines the transferability of acquired strategies to real operational and service activities and constitutes a decisive condition for the programme's effectiveness (Zimmerman, 2000; Stanton *et al.*, 2021). These six foundations form an integrated design framework suitable both for the refinement of A. Fedyk's (2021) original programme and for the development of analogous programmes aimed at fostering professional thinking among specialists from other military, security, and law-enforcement agencies in Ukraine. To provide an operational representation of these foundations compatible with the stages of the targeted professional thinking development model, a "Metacognitive Matrix for the Targeted Development of Professional Thinking in Future Border Guard Officers" (MERIDIAN) was developed. The matrix operationalises the programme's metacognitive architecture across seven parametric dimensions and three developmental stages and is presented in Figure 1. The MERIDIAN matrix is designed for practical use by lecturers of any academic discipline within the professional training system for future border guard officers, as well as at higher military educational institutions of other security and law enforcement agencies in Ukraine. The procedure for using the matrix involves four steps: determining the current stage of cadet training (initial, main, final) using the first column; cross-referencing with the metacognitive component to be activated at this specific stage, and with the dominant type of educational and professional tasks; selecting tasks from the academic discipline in accordance with this type – from procedural tasks at the initial stage to problem-based tasks at the final stage; designing the lesson by adopting the lecturer and cadet roles specified in the corresponding row of the matrix while activating the indicated psychological conditions. For example, at the intermediate stage, a lecturer teaching a professional-cycle discipline organises learning material in the form of communicative and practical tasks, adopts the role of facilitator, maintains the algorithmic sequence of problem-solving, and activates the second, fourth, and fifth psychological conditions through the specific actions described in the previous subsection. Such a sequential reading of the matrix transforms the general metacognitive framework into an operational tool for the day-to-day design of learning activities.

National Academy of the State Border Guard Service of Ukraine			
Metacognitive matrix for the targeted development of professional thinking among future border guard officers			
MERIDIAN			
metacognitive knowledge → monitoring → control			
	I **Initial** cognitive component	II **Main** operational component	III **Final** personal component
I **Programme module**	**Theoretical**	**Educational**	**Emotional and reflective**
II **Model stage**	Diagnostic	Educational	Effective
III **Type of tasks**	**Procedural**	**Communicative** / **Practical**	**Problematic**
IV **Current terms and conditions**	**1 · 3 · 4**	**2 · 4 · 5**	**2 · 5 · 6**
V **The lecturer's position**	Explanation, demonstration of algorithms, diagnostics	Facilitation, consultancy support, feedback	Consultative collaboration, reflective sessions, diary support
VI **The cadet's position**	Learning, type recognition, algorithm reproduction	Monitoring progress, adjusting one's own strategy	Defining the problem, formulating hypotheses, self-regulation
VII **Stage result**	The foundations of metacognitive knowledge	Strong skills in monitoring and control	Self-regulation of professional thinking
Six psychological conditions for enhancing metacognitive regulation			
1. Subject-subject interaction a safe space for articulating strategies		**2. Independent problem-solving** delegation of monitoring and control functions	
3. Motivational reinforcement indirect learning motives		**4. Understanding the task:** monitoring the orientation phase	
5. Sequence of steps Structure of the solution algorithm		**6. Self-awareness and self-assessment** the reflective loop of self-regulation	
"Metacognitive knowledge·monitoring ·control"			

Figure 1. *The MERIDIAN Matrix*

Source*: compiled by the author based on A. Fedyk (2021)*

Prospects for improving a programme for the development of professional thinking based on metacognitive principles

The formulated metacognitive principles of design and the established metacognitive architecture of the programme define three directions for its further improvement, each of which has specific content and corresponds to empirically verified data from contemporary metacognitive psychology. The first direction involves introducing a separate module of explicit metacognitive training into the programme, comprising 8-10 academic hours, which runs in parallel with the theoretical block at the initial stage of professional training. The module should cover three content areas: familiarising cadets with the typology of metacognitive strategies for planning, monitoring and evaluating their own thinking using operational and service situations as examples; keeping a reflective journal of problem-solving tasks, in which the cadet records in writing the chosen strategy, interim assessments of its effectiveness and a final analysis of the appropriateness of its application; group discussion of various strategies for solving the same problem-solving task with the aim of expanding the repertoire of metacognitive techniques. The validity of the module is supported by meta-analysis data indicating that direct instruction in metacognitive strategies, combined with their practical application, is a significant predictor of the effectiveness of self-regulated learning, with the effect of direct instruction exceeding that of indirect activation, as highlighted by C. Dignath & M.V.J. Veenman (2021) and J.D. Stanton *et al.* (2021). In applied educational settings, structured metacognitive prompts enhance the quality of self-regulated learning regardless of the subject area (Guo, 2022). The second direction involves supplementing the diagnostic stage of the structural-functional model of the targeted

development of professional thinking with a psychodiagnostic tool for assessing metacognitive awareness. One such tool is the Metacognitive Awareness Inventory (MAI) by G. Schraw & D. Moshman (1994), developed as a two-factor scale that measures metacognitive knowledge comprising declarative, procedural and conditional components, and metacognitive regulation comprising planning, monitoring, evaluation, correction and information management. Adapting the questionnaire to the context of military professional education involves translating it from the English original, linguistically and culturally adapting the items to the realities of operational and service activities, conducting psychometric testing on a sample of cadets at military higher education institutions, and determining normative indicators for three levels of professional thinking development. The tool introduced into the diagnostic stage tracks the dynamics of a cadet's metacognitive development as an independent dimension alongside the indicators of cognitive, need-motivational and operational criteria of professional thinking defined in A. Fedyk's programme (2021), and provides a basis for the individualisation of further psychological support.

The third direction involves strengthening the affective-regulatory component of the emotional-reflective block by introducing structured procedures for the metacognitive assessment of emotional states prior to decision-making into the final stage of the programme. According to A. Efklides' model (2011), affective states directly influence the accuracy of metacognitive monitoring: underestimated anxiety, excessive confidence or hidden uncertainty distort metacognitive judgements and lead to erroneous control decisions. Within the operational duties of a border guard officer, which unfold under conditions of significant psychological stress and time constraints, affective distortions in monitoring are particularly dangerous. The procedural framework for this area involves the introduction of a brief reflective "state-assessment-decision" model, whereby a cadet, before making a decision in a simulated problem situation, identifies their own emotional state, assesses its impact on clarity of thinking, and only then makes a decision, as well as the regular performance of exercises to recognise their own affective states whilst solving problem-solving tasks and analysing their impact on the quality of the decisions made. This enhancement is consistent with A. Efklides' (2011) theoretical proposition regarding the direct influence of affective states on the quality of metacognitive judgements, which, in the context of highly complex professional activities, manifests itself in the cadet's ability to transfer the strategies they have mastered from training situations to real operational and service activities. The outlined directions for improving the programme do not claim to be empirically verified within the scope of this article and constitute the subject framework for the next empirical study, in which the proposed modifications to the programme will be subjected to experimental testing, recording the dynamics of metacognitive indicators and their relationship with the criteria for the development of professional thinking among future border guard officers.

The theoretical reconstruction of the programme's three-block architecture as an integration of metacognitive knowledge, monitoring and control is consistent with the conceptual generalisations of metacognition by S.M. Fleming (2024), in which the subject's propositional confidence in their own decisions is interpreted as the integrating link between the monitoring and control of cognitive processes. Within this framework, metacognitive judgements are combined with control decisions into a single cycle of monitoring and regulation, demonstrating the conceptual consistency of the programme's three-block architecture with the current state of metacognitive theory. The correspondence identified in the article between the functional content of the programme's theoretical, practical-developmental and emotional-reflective blocks and the structural components of metacognitive regulation provides grounds for viewing the programme as a holistic psychological system for the development of metacognitive regulation of professional thinking, which differs from a set of thematically similar, yet functionally autonomous elements, due to the identified functional correspondence between the programme's blocks and the components of the metacognitive triad. The gap between the development of metacognitive theory and its systematic implementation in higher education programmes, as noted by T. Tuononen *et al.* (2023), has been addressed in the present study through one possible strategy for overcoming it: the theoretical conceptualisation of an already verified programme within its own metacognitive categories. This approach works with the actual subject of professional training for future border guard officers without the need to create a new programme, and provides it with metacognitive clarity at the level of design decisions. The view formulated by C. Magno (2010) view of metacognition as a key factor in the formation of an independent and critical subject has been operationalised in the results obtained through the MERIDIAN metacognitive matrix, which reflects the phased transfer of monitoring and control functions from the lecturer to the cadet across three stages of professional training. Thus, the theoretically formulated goal of developing the subject's metacognitive independence is given concrete practical tools suitable for the day-to-day work of a lecturer in professional disciplines at a higher military educational institution.

The findings presented in this article form part of a broader tradition of metacognitive frameworks for curriculum design, within which specific applied models have emerged in recent years. S. Gamby & C.F. Bauer (2022) described a framework for metacognitive development integrated into the curriculum, built around a single academic discipline and aimed at fostering metacognitive awareness in students through regular reflection within the course. The MERIDIAN metacognitive matrix is distinguished by its scale and functional focus: it sets out the metacognitive architecture of a comprehensive professional training programme for law enforcement

specialists, covering three stages of training, three types of teaching modules and four types of educational and professional tasks. In medical education, J. Merkebu *et al.* (2024) established metacognitive reflection as an integrative framework for examining a specialist's professional thinking in complex clinical situations. The architecture identified in the present study performs a functionally similar role within a military-psychological context, demonstrating the transferability of the metacognitive framework across different domains of professional education, provided that it is adapted to the specific characteristics of operational and service activities. Alongside this, the military study by N.M. Sekel *et al.* (2023) on adaptive decision-making under simulated operational stress confirms the role of metacognitive and self-regulatory factors in the effectiveness of military personnel in environments of uncertainty and time pressure, which thematically corresponds to the operational context of a future border guard officer and justifies the appropriateness of a metacognitive conceptualisation of the programme specifically within this professional profile. Recent empirical studies on the quantification of emotional metacognition by H.-H. Lee *et al.* (2024) confirm the methodological distinction between metacognitive processes in the cognitive and affective spheres, which is methodologically consistent with the function of the emotional-reflective block of the MERIDIAN matrix. The advantage of the proposed approach is its reliance on the already verified programme by A. Fedyk (2021), which frees the theoretical reconstruction from the need for new empirical testing at the level of basic performance and allows for a focus on the metacognitive architecture of the programme within its own psychological categories. At the same time, the limits of this interpretation should be clearly defined: the reconstruction of the metacognitive architecture of the three-block structure has the status of an authorial theoretical conceptualisation; in the original source, metacognitive terminology was not articulated, so the theoretical results obtained are not attributed to the author of the basic programme. The empirical validity of the formulated metacognitive design principles and the additional contribution of the MERIDIAN matrix to the dynamics of cadets' metacognitive indicators, compared with the verified baseline programme, are subject to separate experimental verification in a subsequent study.

✦ Conclusions

The theoretical analysis conducted demonstrated that the metacognitive framework, in its operational form as the triad of "metacognitive knowledge – metacognitive monitoring – metacognitive control", reveals within the verified authorial programme for the targeted development of professional thinking in future border guard officers an underlying psychological architecture that remained theoretically unarticulated in the original source. The programme thereby acquires the status of an integrated system for the targeted development of metacognitive regulation of professional thinking, a status that emerges from its own psychological categories rather than being imposed externally. The identification of a functional correspondence between the programme's three-block structure and the components of the metacognitive triad constitutes the central theoretical finding of the study. The theoretical block was interpreted as the purposeful formation of metacognitive knowledge in its declarative, procedural, and conditional forms. The practical-developmental block acquires the status of the activity-based enactment of monitoring and control through three psychological learning mechanisms (dynamic distribution of management functions, feedback, and task elaboration), which are functionally equivalent to meta-level operations within the operational model of metacognition. The emotional-reflective block is conceptualised as the self-regulatory closure of the metacognitive loop, taking into account the affective-motivational factor, without which metacognitive knowledge and episodic monitoring practice cannot be consolidated into a stable capacity for regulating professional thinking. A comparison of this architecture with the phased logic of training revealed an additional, non-obvious result: the temporal sequence of the three blocks coincides with the psychological logic of the development of metacognitive regulation – from knowledge through monitoring and control to self-regulatory consolidation, which explains the programme's effectiveness precisely on the condition of its full implementation across the three stages of professional training. An analysis of the mechanism of metacognitive supportive learning within a system of four types of tasks demonstrated that the ordering of these types – procedural, communicative, practical and problem-based – along a gradient of uncertainty and autonomy constitutes a design principle: each type of professional task sets a distinct configuration of external support and a corresponding metacognitive load on the cadet's thinking process. The six identified psychological conditions for activating metacognitive regulation formed a cause-and-effect pathway – from a safe space for subject-subject interaction, through the transfer of control functions and motivational reinforcement, to task orientation, structured unfolding of the problem-solving process and reflective closure of the cycle, in which each subsequent condition builds on the previous one, and the omission of any one destroys the integrity of the activation. The synthesis of these conditions into a system of six metacognitive principles of design and their operationalisation within the MERIDIAN matrix has translated the theoretical result into the realm of applied lesson design: the teacher of vocational subjects is provided with a tool that correlates the preparation stage, the dominant metacognitive component, the task type, the positions of the lecturer and the cadet, and the activated psychological conditions within a coordinated design framework. Further research should focus on exploring the possibilities of transferring the proposed metacognitive model to professional thinking development programmes

at higher military educational institutions of other security and law enforcement agencies in Ukraine.

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Метакогнітивні засади проєктування програми цілеспрямованого розвитку професійного мислення майбутніх офіцерів-прикордонників

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✦ **Анотація.** Метакогнітивна регуляція є психологічним ресурсом ефективності професійного мислення офіцерів-прикордонників, чия діяльність відбувається в умовах невизначеності, значних психологічних навантажень і дефіциту часу. Водночас розрив між розробленістю метакогнітивної теорії та її системним застосуванням для концептуалізації існуючих програм розвитку професійного мислення формує актуальну наукову проблему теоретичного характеру. Мета статті – обґрунтувати метакогнітивні засади проєктування програми цілеспрямованого розвитку професійного мислення майбутніх офіцерів-прикордонників шляхом теоретичного аналізу її структурно-функціональних компонентів крізь призму сучасних концепцій метакогніції. Методами дослідження стали теоретичний аналіз і синтез, порівняльний аналіз і концептуальне моделювання; аналітичною рамкою обрано тріаду компонентів метакогніції «метакогнітивне знання – метакогнітивний моніторинг – метакогнітивний контроль». Триблокова структура програми (теоретичний, практико-розвивальний, емоційно-рефлексивний блоки) функціонально узгоджена з компонентами метакогнітивної тріади, а часова розгортка блоків збігається з психологічною логікою розвитку метакогнітивної регуляції впродовж трьох етапів професійної підготовки. Система навчально-професійних завдань чотирьох типів (процедурних, комунікативних, практичних і проблемних) реалізує принцип метакогнітивного підтримувального навчання; визначено шість психологічних умов активізації метакогнітивної регуляції, що утворюють причинно-наслідковий трек у процесі реалізації програми. Сформульовано шість метакогнітивних засад проєктування програми і побудовано метакогнітивну матрицю цілеспрямованого розвитку професійного мислення майбутніх офіцерів-прикордонників (MERIDIAN), що операціоналізує виявлену метакогнітивну архітектуру у параметричних рядах і етапах розвитку. Матриця MERIDIAN призначена як проєктний інструмент для викладача дисциплін професійного циклу у вищому військовому навчальному закладі. Отримані результати придатні для проєктування програм розвитку професійного мислення у вищих військових навчальних закладах інших силових і правоохоронних відомств

✦ **Ключові слова:** підтримувальне навчання; саморегуляція мислення; психологічні умови; рефлексивне замикання; матриця MERIDIAN