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PSYCHOPEDAGOGICAL FRAMEWORK FOR DEVELOPING CLINICAL REASONING THROUGH INTEGRATED LEARNING OF LATIN MEDICAL TERMINOLOGY AND ENGLISH FOR SPECIFIC PURPOSES

Abstract. The article aims to develop a psychological and pedagogical framework that explains the mechanisms underlying the development of clinical reasoning and cognitive flexibility through the integrated study of Latin medical terminology and English for Specific Purposes among medical students. **Methods.** The study is based on a theoretical analysis of scholarly literature in medical education, cognitive psychology, and pedagogy, combined with a conceptual synthesis of the principles of Dual Coding Theory, Conceptual Metaphor Theory, Cognitive Flexibility Theory, the Content and Language Integrated Learning approach, and contemporary models of clinical reasoning. **Results.** The psychological mechanisms underlying the development of professional thinking within an integrated language and discipline-specific learning environment are examined. A multilevel psychological and pedagogical framework integrating cognitive-semantic, cognitive-integrative, and communicative-application dimensions is proposed. It is substantiated that the development of clinical reasoning is facilitated through the sequential interaction of imagery-based encoding, conceptualisation, cognitive integration, knowledge transfer to professional practice, and the reflective restructuring of conceptual knowledge. Latin medical terminology is shown to perform a cognitive-semantic function by facilitating the formation and structuring of professional concepts, whereas English for Specific Purposes provides a communicative environment for their practical application in clinical case analysis, professional interaction, and diagnostic decision-making. **Scientific novelty.** The scientific novelty of the study lies in the development of a multilevel psychological and pedagogical framework that theoretically substantiates the interaction between the cognitive-semantic functions of Latin medical terminology and the communicative-application potential of English for Specific Purposes in the development of clinical reasoning and cognitive flexibility among medical students. **Practical significance.** The developed model may serve as a theoretical basis for designing and implementing integrated courses in Latin medical terminology and English for Specific Purposes, as well as for developing learning activities aimed at fostering clinical reasoning, cognitive flexibility, and the transfer of professional knowledge from the preclinical stage of medical education. **Conclusion.** The proposed framework extends the current theoretical understanding of the relationship between cognitive processes, language education, and clinical reasoning and demonstrates the potential of integrated language and discipline-specific learning for supporting the development of professional thinking among medical students.

Key words: clinical reasoning, Latin medical terminology, English for specific purposes, psychopedagogical framework, cognitive flexibility, medical students, medical education.

ПСИХОПЕДАГОГІЧНА ОСНОВА РОЗВИТКУ КЛІНІЧНОГО МИСЛЕННЯ ШЛЯХОМ ІНТЕГРОВАНОГО ВИВЧЕННЯ ЛАТИНСЬКОЇ МЕДИЧНОЇ ТЕРМІНОЛОГІЇ ТА АНГЛІЙСЬКОЇ МОВИ ДЛЯ КОНКРЕТНИХ ЦІЛЕЙ

Анотація. Метою статті є розроблення психолого-педагогічної концепції, що пояснює механізми розвитку клінічного мислення та когнітивної гнучкості здобувачів вищої медичної освіти через інтегроване вивчення латинської медичної термінології та англійської мови за професійним спрямуванням. Методи. У дослідженні використано методи теоретичного аналізу наукових праць із медичної освіти, когнітивної психології та педагогіки, а також концептуального синтезу положень теорії подвійного кодування, теорії концептуальної метафори, теорії когнітивної гнучкості, концепції предметно-мовного інтегрованого навчання та сучасних моделей клінічного мислення. Результати. Розглянуто психологічні механізми розвитку професійного мислення в умовах інтегрованої мовної та фахової підготовки. Запропоновано багаторівневу психолого-педагогічну концепцію, яка поєднує когнітивно-семантичний, когнітивно-інтегративний і комунікативно-діяльнісний рівні. Обґрунтовано, що розвиток клінічного мислення забезпечується послідовною взаємодією механізмів образного кодування, концептуалізації, когнітивної інтеграції, перенесення знань у професійну діяльність і рефлексивної перебудови концептуальних структур. Показано, що латинська медична термінологія виконує когнітивно-семантичну функцію, сприяючи формуванню та структуруванню професійних концептів, тоді як англійська мова за професійним спрямуванням забезпечує комунікативне середовище для їх практичного застосування під час аналізу клінічних випадків, професійної взаємодії та прийняття діагностичних рішень. Наукова новизна дослідження полягає у розробленні багаторівневої психолого-педагогічної концепції, яка теоретично обґрунтовує взаємодію когнітивно-семантичних функцій латинської медичної термінології та комунікативно-діялісного потенціалу англійської мови за професійним спрямуванням у розвитку клінічного мислення та когнітивної гнучкості здобувачів вищої медичної освіти. Практичне значення. Запропонована концепція може слугувати теоретичною основою для проєктування та впровадження інтегрованих курсів латинської медичної термінології й англійської мови за професійним спрямуванням, а також для розроблення навчальних завдань, спрямованих на розвиток клінічного мислення, когнітивної гнучкості та перенесення професійних знань уже на доклінічному етапі медичної освіти. Висновок. Запропонована концепція розширює сучасні наукові уявлення про взаємозв'язок когнітивних процесів, мовної підготовки та клінічного мислення й демонструє потенціал інтегрованого мовного та фахового навчання для розвитку професійного мислення здобувачів вищої медичної освіти.

Ключові слова: клінічне мислення, латинська медична термінологія, англійська мова за професійним спрямуванням, психолого-педагогічна концепція, когнітивна гнучкість, здобувачі вищої медичної освіти, медична освіта.

Introduction. Contemporary medical education is undergoing a profound transformation driven by changing conceptions of the professional preparation of medical students. Traditional medical curricula have primarily emphasized the acquisition of extensive biomedical and clinical knowledge. Contemporary medical education, however, increasingly focuses on developing the cognitive processes that underpin effective clinical reasoning. These include the ability to analyse complex clinical situations, integrate knowledge from multiple domains, make evidence-informed decisions under conditions of uncertainty, and communicate effectively within the international medical community. Consequently, the education of future physicians is increasingly understood not merely as the development of professional competencies but also as the cultivation of cognitive flexibility, reflective thinking, and professional creativity.

One of the major directions in the modernization of medical education is the integration of linguistic and professional training. Knowledge of Latin medical terminology has traditionally constituted the foundation of the professional language of medicine, whereas English for specific purposes provides access to international scientific literature, professional communication, and clinical interaction. Nevertheless, most studies continue to treat Latin medical terminology and English for specific purposes as relatively independent components of professional education whose primary function is to develop terminological, linguistic, or communicative competence.

Analysis of research and publications. In recent years, clinical reasoning has emerged as a key area of scholarship in medical education. The field has been shaped by influential contributions from R.W. Eva,

H. G. Schmidt, S. Mamede, M. K. Hawks, and M. Elvén. R. W. Eva, H. G. Schmidt, and S. Mamede argue that the quality of clinical decision-making depends not merely on the quantity of knowledge acquired but, more importantly, on the ways in which that knowledge is organized, integrated, transferred to unfamiliar professional contexts, and continuously reconstructed through reflective processes. Similarly, M. K. Hawks and M. Elvén emphasize, based on recent systematic reviews, the need for comprehensive theoretical models capable of explaining the psychological mechanisms underlying the development of clinical reasoning during the preclinical phase of medical education [14; 12].

Parallel developments in cognitive psychology and educational research have generated substantial theoretical evidence concerning the mechanisms underlying the acquisition of complex professional knowledge. J. M. Clark and A. Paivio explain, through Dual Coding Theory, the interaction between verbal and visual representations of information. G. Lakoff and M. Johnson demonstrate, through Conceptual Metaphor Theory, the role of metaphorical structures in the formation of professional concepts. R. J. Spiro proposes Cognitive Flexibility Theory to explain the adaptive reconstruction and application of knowledge in complex and ill-structured domains. D. Coyle, P. Hood, and D. Marsh develop the Content and Language Integrated Learning (CLIL) approach as a theoretical basis for integrating disciplinary content with language instruction. Together, these theoretical perspectives offer complementary explanations of the mechanisms underlying the acquisition of complex professional knowledge.

Ukrainian scholars have likewise contributed to the development of interdisciplinary approaches in medical education, medical terminology, and professionally oriented language instruction. A. H. Shulhai, L. Ya. Fedoniuk, A. Ye. Mudra, and O. M. Oleshchuk emphasize interdisciplinary integration as a fundamental component of problem-based learning and professional training for future physicians. N. O. Fedchyshyn further highlights the importance of psycho-pedagogical preparation in fostering reflective thinking, communication, and the integration of professional competencies. M. M. Zakaliuzhnyi, M. A. Andreichyn, and R. R. Komarovskiy, as well as L. I. Petrukh and I. M. Holovko, demonstrate the educational value of integrating Latin, English, and Ukrainian medical terminology for developing systematic conceptual understanding and professional communication. Cognitive aspects of terminology have also been addressed by Yu. B. Brazhuk, Yu. V. Kravtsova, and A. V. Tkach, whose studies explain the role of

metaphorical and lexical-semantic structures in the conceptualization of medical knowledge. In addition, N. V. Vorona examines pedagogical approaches to teaching medical terminology, while O. S. Pasichnyk and O. O. Pasichnyk substantiate the potential of content and language integrated learning (CLIL) for strengthening competency-based foreign language education through closer integration of disciplinary content and language instruction. Collectively, these studies provide important theoretical and methodological foundations for interdisciplinary medical education; however, they primarily address terminology, language teaching, curriculum integration, and competency development as separate domains.

A review of the contemporary literature therefore reveals a significant research gap. Despite the considerable body of scholarship on Latin medical terminology, English for specific purposes, content and language integrated learning, and clinical reasoning, these research areas have rarely been examined within a unified theoretical perspective. Their interrelationships remain insufficiently conceptualized in contemporary medical education research. Consequently, there is still no comprehensive psychopedagogical framework explaining how the integrated study of Latin medical terminology and English for specific purposes supports the cognitive mechanisms underlying the development of future physicians' clinical reasoning.

The aim of this article is to provide a theoretical substantiation of the psychological and pedagogical mechanisms underlying the development of medical students' clinical reasoning through the integration of Latin medical terminology and English for specific purposes within higher medical education. To achieve this aim, the study pursues the following objectives: (1) to analyse contemporary psychological, pedagogical, and medical education approaches to the development of medical students' clinical reasoning; (2) to substantiate the psychological mechanisms, namely dual coding, conceptualization, cognitive integration, knowledge transfer, and reflective restructuring, that underpin the integrated learning of Latin medical terminology and English for specific purposes; (3) to examine the role of integrating Latin medical terminology and English for specific purposes in fostering professional concept formation, cognitive flexibility, clinical reasoning, and professional communication among future physicians; and (4) to propose an integrated theoretical framework that explains the relationships among the cognitive-semantic, cognitive-integrative, and communicative-application levels involved in the development of professional creativity and clinical reasoning throughout medical education.

Theoretical Framework. Contemporary medical education increasingly extends beyond the transmission of factual knowledge toward the development of complex cognitive processes that support clinical decision-making. Language and medical terminology are increasingly recognized as cognitive tools that shape the development of professional thinking rather than merely facilitating communication. In particular, the combined study of Latin medical terminology and English for specific purposes may play a more significant role than traditionally assumed, as it potentially shapes how future physicians construct, organize, and apply medical knowledge in clinical contexts.

Despite substantial progress in the fields of medical education, clinical reasoning, CLIL, and cognitive psychology, these areas have largely developed along parallel trajectories. Research on Latin medical terminology tends to focus on etymology and terminological competence, while English for specific purposes is usually examined in relation to communicative proficiency. At the same time, studies in clinical reasoning emphasize the organization and flexible use of knowledge, whereas cognitive theories such as Dual Coding Theory, Conceptual Metaphor Theory, and Cognitive Flexibility Theory remain only partially connected to language-based medical education.

A similar tendency can be observed in Ukrainian scholarship. In particular, A. H. Shulhai, L. Ya. Fedoniuk, A. Ye. Mudra, and O. M. Oleshchuk demonstrate that integrating biomedical disciplines enhances students' ability to establish conceptual links between basic sciences and clinical practice, thereby supporting the development of professional competence in problem-based learning environments [9]. However, their interpretation of integration is predominantly structural, focusing on curricular coordination rather than on the psychological processes through which interdisciplinary knowledge is transformed into clinical reasoning. In contrast, N. O. Fedchyshyn extends this discussion by emphasizing the psycho-pedagogical dimension of medical education, arguing that reflective learning, communication, and professional identity emerge through the interaction of cognitive and educational factors rather than through disciplinary knowledge alone [8]. At the same time, Ukrainian studies primarily address interdisciplinary integration as an organizational and methodological principle. However, it has paid limited attention to the cognitive mechanisms through which language learning contributes to the development of clinical reasoning. This observation further substantiates the need for an integrated psychopedagogical framework.

Against this background, the present study proposes a theoretical model that conceptualizes the integration of Latin medical terminology and English for specific purposes as a multilevel psychopedagogical system. Rather than treating language learning and professional reasoning as separate domains, this framework assumes that they interact through a set of interconnected cognitive mechanisms operating at different levels of processing. The framework comprises three interrelated levels: (1) the cognitive-semantic level, at which Latin medical terminology facilitates the formation of professional concepts through etymological analysis and metaphorical conceptualization; (2) the cognitive-integrative level, where individual concepts are organized into interconnected knowledge structures that support the flexible transfer of knowledge across diverse clinical contexts; and (3) the communicative-application level, in which English for specific purposes provides opportunities to apply conceptual knowledge through professional communication, clinical case analysis, and problem-solving activities.

At the foundational level, the cognitive-semantic dimension is shaped by Dual Coding Theory [10; 17] and Conceptual Metaphor Theory [15]. From this perspective, Latin medical terminology does not function as a set of isolated lexical units but as a system that simultaneously activates verbal and visual representational networks. The etymological structure of medical terms facilitates the formation of stable mental images and supports conceptual grounding, as exemplified by the Latin term *musculus*, derived from *mus* ("mouse"), not only denotes an anatomical structure but also evokes the image of a small animal moving beneath the skin, thereby establishing a stable cognitive association between linguistic form and anatomical function [6, p. 645]. As a result, the term acquires cognitive salience that facilitates both conceptual understanding and long-term retention. Many anatomical terms are historically rooted in metaphorical extensions from everyday experience, which allows abstract medical concepts to become cognitively accessible and meaningfully structured, e.g., such terms as *bulbus*, *cortex*, *radix*, and *cornu* do not merely designate anatomical entities but also reflect the conceptual processes through which these structures are understood [6]. Consequently, metaphor serves a fundamentally cognitive rather than a merely decorative function. It enables professional concepts to be constructed on the basis of existing experiential knowledge. In this sense, lexical knowledge contributes directly to the formation of professional concepts rather than merely labelling them.

The cognitive role of metaphor in professional terminology has also been examined by Ukrainian

linguists. Yu. V. Kravtsova demonstrates that metaphorization represents a fundamental cognitive mechanism of conceptual modelling rather than merely a stylistic phenomenon [4]. Similarly, Yu. B. Brazhuk, analyzing anatomical and clinical terminology, argues that metaphorical transfer facilitates the conceptualization of medical phenomena by linking abstract scientific concepts with familiar perceptual experience [1]. These findings complement Lakoff and Johnson's Conceptual Metaphor Theory and further support the assumption that etymological analysis of Latin medical terminology contributes to the formation of stable professional concepts.

The cognitive-integrative level is concerned with how individual concepts are organized into coherent and flexible knowledge structures. Here, Cognitive Flexibility Theory [19] provides a useful explanatory lens, as it emphasizes the importance of multiple representations and non-linear knowledge organization in complex domains. In medical terminology learning, morphological patterns and word-formation systems facilitate the recognition of relationships among terms. We think they support the development of interconnected conceptual networks rather than the memorization of isolated vocabulary items. Terms derived from the same root allow learners to perceive functional and structural relationships within anatomical systems. For example, words containing the root *card*, namely *cardiology*, *myocardium*, *endocardium*, *cardiomegaly*, and *pericardium*, enable learners to conceptualize these items not as isolated lexical units but as components of a unified conceptual system describing the structure, function, and pathology of the heart. This process supports the development of adaptable knowledge structures that can be reorganized in response to new clinical information.

A comparable interpretation is found in Ukrainian terminological research. A. V. Tkach views medical terminology as a hierarchically organized lexical-semantic system in which individual terms derive their meaning from systematic conceptual relations [7]. Likewise, the multilingual medical encyclopedic dictionary compiled by L. I. Petrukh and I. M. Holovko, together with the work of M. M. Zakaliuzhnyi, M. A. Andreichyn, and R. R. Komarovskiy, illustrates that Latin terminology functions as the structural core linking Ukrainian and English medical nomenclature [6; 3]. Their work confirms that systematic terminology instruction facilitates conceptual integration rather than rote memorization of isolated lexical items.

The third, communicative-application level is realized through English for specific purposes and CLIL-oriented instruction [11]. At this stage, knowledge becomes operationalized in

communicative and task-based contexts, including clinical case analysis, interpretation of medical literature, and professional interaction. Language functions here as a mediating tool through which conceptual knowledge is externalized, tested, and refined. Similar conclusions are reported by N. V. Vorona. The scholar argues that systematic instruction in medical terminology should integrate linguistic, conceptual, and professional components to facilitate both terminological competence and professional communication among medical students [2, p. 14]. Importantly, this process enables the transfer of abstract terminological and conceptual knowledge into authentic professional situations, thereby bridging the gap between classroom learning and clinical practice.

This interpretation is also consistent with recent Ukrainian studies on CLIL methodology. O. S. Pasichnyk and O. O. Pasichnyk emphasize that CLIL should not be regarded merely as a language-teaching approach but as a competency-oriented educational technology that integrates disciplinary knowledge with foreign language learning. Their conclusions support the assumption adopted in the present framework that English for Specific Purposes functions as a mediating environment through which professional concepts are operationalized in authentic communicative and clinical contexts [5].

The proposed psychopedagogical framework conceptualizes clinical reasoning as a dynamic cognitive outcome rather than a discrete skill. It emerges from the continuous interaction of semantic activation, knowledge integration, and communicative application. Contemporary research in medical education suggests that clinical reasoning depends less on the accumulation of knowledge than on its organization and flexible retrieval in contextually variable situations [13; 18; 16]. In this framework, reflective processes play a central role in enabling learners to reassess and restructure their conceptual understanding when confronted with new clinical problems.

An important implication of this framework is that professional creativity in medicine should not be understood as the production of entirely novel ideas. Instead, it should be viewed as the ability to recombine and adapt existing knowledge structures in response to complex clinical demands. When students engage simultaneously with Latin terminology and ESP-based communicative tasks, they are required to shift between conceptual, linguistic, and clinical representations of knowledge. This continuous movement across representational systems fosters cognitive flexibility and supports the emergence of creative and context-sensitive clinical reasoning.

Taken together, the proposed framework suggests that the educational value of integrating Latin medical terminology with English for specific purposes lies in its capacity to activate a chain of mutually reinforcing cognitive processes. Semantic encoding through etymological analysis and conceptual organization through morphological systems support the development of clinical reasoning. Their integration with communicative activation through ESP-based tasks enables students to apply conceptual knowledge effectively in clinical contexts. Rather than functioning as separate instructional components, these processes form an integrated psychopedagogical system in which language learning becomes inseparable from cognitive development in medical education.

Conclusions. This study suggests that the integration of Latin medical terminology and English for specific purposes should be understood as a unified psychopedagogical process rather than as the parallel development of two separate language components. Its main contribution lies in showing how linguistic training may be directly linked to the formation of clinical reasoning and professional thinking in medical education. The analysis indicates that this development is supported by the interaction of several cognitive mechanisms, including dual coding, conceptualization, cognitive integration, knowledge transfer, and reflective restructuring. In this process, Latin terminology contributes to the formation of structured professional concepts, while cognitive integration supports their organization into coherent knowledge systems. English for specific purposes then enables the practical use of this knowledge in communicative and clinical contexts. These findings collectively support an integrated view in which clinical reasoning emerges from the dynamic interaction between linguistic, cognitive, and educational processes. This perspective brings together key insights from Dual Coding Theory, Conceptual Metaphor Theory, Cognitive Flexibility Theory, and CLIL within a single explanatory framework.

The proposed framework offers a theoretical basis for developing more integrated approaches to teaching Latin medical terminology and English for Specific Purposes in preclinical medical education. Future research should focus on testing this framework empirically and exploring its effectiveness in real educational settings.

Information on the use of artificial intelligence.

The authors certify that, in the course of conducting the research and preparing this manuscript, they did not use any generative artificial intelligence tools or services to perform any of the tasks listed in the Generative Artificial Intelligence Delegation

Taxonomy (GAIDeT, 2025). All stages of the work – from conceptualization to final editing – were carried out exclusively by the authors, without the use of generative artificial intelligence

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