

of using AI in education and science from the perspective of students. **Conclusions.** The results of the empirical study showed a high level of integration of AI into students' learning activities, in particular for information retrieval, text editing, planning, or idea generation. At the same time, a number of ethical challenges have been identified: an unclear distinction between acceptable and unacceptable forms of AI use, the “shifting” of moral responsibility from the user to AI technologies, and a low level of legal awareness of copyright and academic integrity.

Keywords: academic integrity; higher education students; intellectual property; educational environment; artificial intelligence.

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LANGUAGE EVOLUTION IN THE SOCIOCULTURAL DIMENSION AS A KEY TO HUMAN COGNITION

Abstract

This article presents a comprehensive analysis of language as both an evolutionary and sociocultural phenomenon that plays a fundamental role in shaping human cognitive activity. The author examines language not merely as a tool of communication but as a profound system for interpreting reality – one that integrates biological, mental, and cultural components. The article outlines core features of language, including semanticity, openness, cultural transmission, displacement, discreteness, prevarication, and reflexivity, all of which collectively enable language to structure knowledge, model representations of the world, and facilitate reflective thought. The link between linguistic reflexivity and the development of higher-order mental processes is explored, highlighting the unique role of language in the evolution of human consciousness.

Special attention is given to comparing the human linguistic system with communicative signals in animals, revealing fundamental distinctions between biologically pre-programmed systems and consciously regulated speech. The author argues that language evolved not only from physiological mechanisms – such as the anatomy of the larynx and vocal tract – but also as a sociocultural achievement shaped through learning, interaction, and the transmission of experience. The study emphasizes the formative role of cultural context in shaping linguistic worldviews and points to the cognitive flexibility that allows language to adapt to new meanings, contexts, and communicative demands. Thus, language is presented as the product of multidimensional development in which biological evolution, mental capacities, and sociocultural dynamics are inextricably intertwined in the formation of human cognition.

The purpose of the article is to provide a theoretical substantiation and analytical overview of human language as the basis of cognition, with special attention to its anatomical, cognitive and socio-cultural foundations. The tasks of the article are focused on identifying a set of key linguistic properties that determine the linguistic potential of language, as well as on substantiating the unbroken link between the development of language and the formation of human thinking.

Conclusion. *The study concludes that language functions not merely as a medium of communication, but as a fundamental instrument for knowledge acquisition and conceptualization. Unlike animal signaling systems, human speech is marked by its flexibility, productivity, and intentional use, enabling the articulation of abstract meanings, the construction of complex utterances, the expression of volitional and emotional states, the development of scientific models, and reflection on one's own linguistic activity. Given the sociocultural context in which linguistic ability emerges, the study emphasizes the significance of environment, tradition, and education as key factors shaping each community's linguistic worldview. Additionally, the findings highlight the essential role of anatomical and neurophysiological conditions – such as breath control, articulatory mobility, and the capacity for voluntary speech – in the development of linguistic competence. Thus, language is presented as a multidimensional phenomenon in which biological evolution, mental processes, and sociocultural influences are intricately intertwined, collectively enabling the growth of human cognition, the structuring of thought, and the transmission of experiential knowledge, thereby fulfilling the stated objectives of the study.*

Keywords: language evolution; sociocultural dimension; language properties; human cognition.

Introduction. A defining trend in global education today is the modernization of educational systems, accompanied by significant changes in both theoretical and practical approaches to the learning process within institutions of higher education. The goals and objectives of language training in higher education have evolved over time, influenced by political, economic, and cultural shifts within Ukrainian society. In conducting this study on the theoretical foundations of professional language training in higher education institutions, it is essential to analyze the nature of language itself – its origins, defining features, and core characteristics – since these aspects offer a deeper understanding of its internal structure, functional potential, and role in shaping and advancing human development. Such awareness, in turn, is crucial for a more nuanced exploration of language as a foundation of professional training within technical universities, where it serves not only a cognitive function but also performs integrative, adaptive, and communicative roles within the educational environment.

According to the work of leading Ukrainian scholars (V. Andrushchenko, F. Batsevych, A. Bohush, O. Ponomariova, I. Zyazyun, I. Kobylanska, A. Pohribnyi), as well as internationally recognized researchers – including biolinguists (Derek Bickerton, Philip Lieberman), cognitive scientists (Michael Tomasello, George Lakoff), evolutionary linguists (Steven Mithen, Tecumseh Fitch), and theorists of language and culture (Noam Chomsky, Yuval Harari) – linguistic thought at the turn of the 20th and 21st centuries has increasingly moved toward a comprehensive understanding of language as a mechanism for conceptualization, a tool of cognitive interaction, and a repository of cultural memory. While these scholars differ in methodology – from biolinguistics to cognitive and ethnolinguistic approaches – they are united by the recognition of language as a central factor in shaping worldviews.

In this study, we draw primarily on those frameworks that allow for an examination of language in close connection with thought, sociocultural context, and professional activity. Of particular importance are theories that conceptualize language evolution as a long-term bio-cognitive process in which language emerged not merely as a communication tool but also as a means of coordinating actions, shaping shared identity, and adapting to shifting social realities (see Tomasello, 2008; Harari, 2018). This perspective allows for a more profound understanding of language as a phenomenon shaped by a complex evolutionary trajectory, and it provides a scholarly foundation for analysing contemporary linguistic practices (Drew, 2009). We aim to demonstrate that language is a multifunctional tool of communication and world comprehension, one that preserves cultural experience, ensures historical continuity, and enables the construction of shared worldviews within specific cultural settings. Its multidimensional nature not only supports the transmission of past experience but also facilitates the constant renewal of knowledge and values passed between generations within a community. This underscores the fundamental role of language in the formation of cultural memory and collective identity, as emphasized by scholars such as B. Hrinchenko, Yu. Shevelov, N. Davies, and Y. Harari. At the same time, we aim to identify those characteristics that are common to all languages and may serve as their defining universal features.

The purpose of this study is to provide an analytical overview of key conceptual questions related to the fundamental factors that shape human language as a basis for cognition, with a focus on its anatomical, mental, and sociocultural prerequisites.

The study **objectives** are:

- to identify and define a set of linguistic properties that underpin the cognitive potential of language;
- to demonstrate the inseparable connection between language development and the formation of human thought.

Research Methods and Methodology. To achieve the study's purpose, a range of scientific methods was employed, each directed toward uncovering the unique features of language as a cognitive tool within an evolutionary and sociocultural framework. Terminological analysis was applied to clarify the meanings of key concepts such as language evolution, sociocultural dimension, and cognitive activity, as well as to develop a coherent conceptual framework. Theoretical generalization and literature analysis enabled the examination of language's multidimensional nature and its role in the development of human consciousness. A systems-structural approach was used to explore the interrelationship between the anatomical and physiological foundations of speech, cognitive capacities, and the sociocultural conditions that shape linguistic competence. In addition, a comparative-analytical method was employed to contrast human language with animal communication systems, in order to identify the distinctive features of human speech as a medium of knowledge formation.

Results. Summarizing the findings of the conducted analysis alongside original theoretical insights, we argue that human speech requires the integration of a complex set of unique properties, including:

- anatomical factors (such as the low positioning of the larynx, precise coordination of speech-related

muscles, and the structural configuration of the vocal tract);

- physiological mechanisms (including a well-developed system for respiratory control, regulation of vocal power, and synchronized functioning of the respiratory and phonatory musculature);

- cognitive capacities (such as conscious control over speech production, the ability for abstract reasoning, lexical-semantic associativity, and neural activation across linguistic and sensory areas of the brain).

In our view, this multilayered integration is a defining condition of the uniqueness of human speech and serves as a conceptual foundation for effective professional language training.

These properties can be fully actualized only within a communicative system capable of operating with an immense – and potentially infinite – inventory of signs. As contemporary linguistics has shown (Tomasello, 2003; Shea, 2011), no example of a “reduced” language has been identified in nature – that is, a communicative system with a limited number of signs that nonetheless features grammatical structure and mechanisms for indirect meaning transmission. Based on this, we draw a key conclusion: the evolutionary shift from a basic communicative system to a grammatically organized language represents the moment at which the number of linguistic signs became theoretically limitless.

This transformation marks the emergence of all core features that distinguish human language from other forms of natural communication, and it accounts for its unique capacity to serve not only as a medium of transmission but also as a mechanism for the creation of knowledge, the preservation of social experience, and the development of professional linguistic competence.

At this stage of our analysis, a new line of inquiry emerges – namely, the need to investigate which environmental factors became so critical for early humans that they necessitated such a powerful communicative system, one capable of representing a vast range of concepts, from the most concrete to the most abstract. Accordingly, it becomes essential to determine when, why, and in which ancestral species the organism’s energy budget developed in such a way that sustaining this expansive linguistic system became possible without compromising overall biological fitness. Addressing this question is of fundamental importance, as it offers deeper insight into the evolutionary conditions that gave rise to language and highlights its essential role in the formation of human society.

Discussion. The classification of linguistic features has long been a subject of interest among linguists, cognitive scientists, and philosophers of language (notably S. Pinker, M. Tomasello, E. Clark, and N. Chomsky). While the academic discourse includes a wide range of approaches to defining the essential properties of language, this study draws on the systemic framework proposed by American linguist Charles Hockett and his colleagues, including E. Severance, S. Stebbins, and J. Lyons. These scholars, through comparative analyses of human language and the communicative systems of animals (such as primates, birds, and insects), identified over a dozen universal features of language. Among the most significant are semanticity, openness, cultural transmission, displacement, discreteness, prevarication, and reflexivity – each of which is discussed in more detail below:

a) Semanticity refers to the way certain elements of language represent entities and phenomena in the external world (e.g., the word *grove* denotes a type of landscape, *blue* a colour, to hear a sensory perception). Any communicative system in which signals represent external referents – distinct from the signals themselves – exhibits this property. For instance, a scream of fear in humans or animals is a direct part of the emotional state and does not signify a distinct external concept, thus lacking semantic separation.

b) Openness denotes the human capacity to produce and comprehend an unlimited number of new utterances from a finite set of basic units. This is achieved either through novel combinations or by attributing new meanings to existing elements. As noted by Hockett, and echoed by scholars such as Pinker, Tomasello, Clark, and Chomsky, human language is inherently productive, capable of generating infinite messages, describing the external world, and expressing subjective perspectives and emotional nuance.

Unlike humans, animals cannot construct complex communicative structures that reflect unique perspectives or deep awareness of events and experiences. While many species employ sounds or gestures for signaling, such communication tends to be instinctive, context-bound, and limited in its ability to convey abstract concepts or evaluative judgments.

c) Cultural transmission highlights that while the capacity for language acquisition is innate in humans, the specific language – its vocabulary, grammar, and phonology – is acquired socially, not genetically. For example, children raised in multilingual environments often master multiple languages and internalize diverse cultural codes. Research in anthropology, developmental psychology, and cognitive linguistics confirms that children, regardless of origin, acquire the languages active in their surroundings, underscoring the sociocultural – not biological – foundation of language learning.

d) Displacement is the ability to use language to refer to things that are not immediately present in

time or space. Speakers can describe past journeys or discuss future intentions – an ability that presupposes mental representation of time, space, and hypothetical actions, and is critical to human cognitive development.

e) Discreteness means that distinct linguistic expressions differ from one another by identifiable units. For instance, the sentences *This is a house* and *This is smoke* differ in one vowel sound, changing the meaning entirely. Human language is governed by clearly defined rules and discrete units, with no seamless transitions between symbols, which allows for precise expression and interpretation.

f) Prevarication refers to the capacity of human language to convey false, illogical, or fictional statements. This property enables storytelling, imagination, and scientific hypothesis formation. Consider the early heliocentric model: although initially counterintuitive, language made it possible to express, refine, and eventually validate the idea that Earth orbits the Sun.

g) Reflexivity is the capacity to use language to describe itself. This meta-linguistic feature allows speakers to analyse grammar, reflect on syntax, debate word meanings, and formalize language rules. Reflexivity underpins the development of grammar theory, linguistic awareness, and educational methodologies.

In linguistics, this property – reflexivity – forms the foundation for the emergence of metalanguage, a specialized linguistic system used to describe and analyse language phenomena. For this reason, reflexivity is considered critically important for the development of linguistic disciplines, pedagogical methodologies, and for the cultivation of conscious, deliberate language use.

Based on the features proposed by Charles Hockett and further developed in the works of modern linguists and cognitive scientists – particularly those aligned with the cognitive approach to language research – it may be argued that among all animal communication systems, the one that most closely resembles human language is that of the honeybee (*Apis mellifera*). Their famous “waggle dance” demonstrates several key features of language, including productivity and displacement, and serves as an example of a specialized communicative act. Moreover, bees are not only capable of transmitting signals but also of interpreting them, indicating the presence of basic interchangeability, a characteristic component of human linguistic behavior (Tomasello, 2003).

However, as Hockett and his followers emphasize, no animal communication system exhibits the full set of linguistic properties simultaneously, and this marks a fundamental boundary between human speech and other natural forms of communication. This observation invites deeper reflection on the uniqueness of human language, not merely as a tool for transmitting information but as a complex cognitive structure that underlies our very capacity to think, plan, and make sense of the surrounding world.

Another example often cited for its partial similarity to human linguistic behavior involves vervet monkeys (a primate species). In the presence of danger, vervets engage in distinct vocal signaling, emitting specific alarm calls that correspond to different types of threats. Within this signaling system, basic elements can be combined in varying ways to convey different meanings – for instance, one vocalization may indicate a terrestrial predator, while another refers to aerial danger. This illustrates a form of semantic differentiation akin to how different combinations of sounds in human language form words with distinct meanings. As such, vervet signaling may be described as quasi-semantic; however, its flexibility and complexity remain limited in comparison to human language (Clark, 2014).

This phenomenon can be explained by the fact that the external form of animal signals – their acoustic structure – is innate. As a result, the expansion of such communicative systems and the incorporation of new signals can occur only through genetic mutation.

In contrast, human language is neither fixed nor genetically predetermined. Its symbolic system is shaped through socialization, continuously enriched and transformed in response to emerging needs, shifting contexts, and evolving cultural challenges. While animal signals are limited and pre-programmed, the human linguistic system is characterized by openness – the ability to generate new words, concepts, and structures. This dynamic nature of language is well documented in contemporary cognitive and sociolinguistic research (Tomasello, 2003; Clark, 2014), which reports numerous instances of linguistic innovation driven by cultural transformation, technological advancement, and sociopolitical change (Progovac, 2019).

However, it is important to note that articulated sound alone cannot serve as a definitive criterion for identifying a system as linguistic. There are communicative practices that rely on alternative modalities for segmenting linguistic flow. According to the analytical logic of this study, such examples support the view that language is not solely an acoustic phenomenon, but rather an organized system of meaning capable of functioning across multiple modalities – including auditory, visual, and tactile channels. For example, in Mandarin Chinese, tonal variation plays a decisive role in semantic differentiation, while in signed

languages (such as American Sign Language, ASL), this function is fulfilled through nonverbal means such as gestures, facial expressions, and body positioning. As David Geary insightfully points out, such cases demonstrate that the structuring of language is not an exclusive prerogative of sound (Drew & David, 2009).

Another key parameter of language is its lexical capacity – the human ability to acquire and manipulate a vast number of lexical units. According to researchers, even the basic vocabulary of an average speaker encompasses tens of thousands of words, whereas the most advanced nonhuman primates typically master only a few hundred communicative signs. A series of experiments involving the teaching of language elements to great apes shows that, despite a notable degree of adaptability, most are capable of retaining only a limited set of object names or basic actions (Harari, 2018). Based on our analysis, this limitation reflects not only structural-functional differences in the vocal apparatus, but also significant disparities in cognitive potential. For instance, the chimpanzee larynx is anatomically positioned higher than that of humans, which prevents the production of fully articulated speech and limits the ability to regulate breathing rhythm – an essential condition for generating a complex phonological system.

In light of the above, it is logical to further specify the anatomical factors that directly influence the development of human linguistic capacity. One widely accepted hypothesis suggests that the low positioning of the larynx is critically important for articulated speech, as it allows for increased mobility of the tongue within the vocal tract – both horizontally and vertically. This anatomical configuration significantly broadens the range of sounds humans are capable of producing, laying the foundation for the rich phonetic diversity observed across the world's languages. In our view, this mechanism represents not only a physiological prerequisite for speech, but also an evolutionary achievement that enabled the emergence of complex linguistic structures supporting abstract thinking, social organization, and the transmission of cultural knowledge (Leutner, 2009). Consequently, we may infer that without this specific anatomical feature, human speech would be severely limited: reduced sound variability would result in a narrow range of distinguishable linguistic units, thereby making the formation of elaborate language systems virtually impossible.

Moreover, as noted by N. Koliada, each phonological element of a word is characterized by a distinct loudness or acoustic intensity. The primary function of speech-related breathing is to regulate this variability – dampening overly strong signals while amplifying weaker ones. This is accomplished through the precise movements of the diaphragm, which modulates respiratory patterns to match the needs of speech production (Koliada, 2018).

Such a process demands fine-tuned control by the nervous system, particularly the neural circuits responsible for coordinating the respiratory and articulatory musculature. Neurophysiological studies (Leutner, 2009; Overmann, 2000) confirm that nonhuman primates lack voluntary control over respiration, and their vocalizations occur during both inhalation and exhalation. This limitation significantly constrains their ability to produce the complex sound patterns required for human speech.

Another defining feature of human language is its regulation by volition rather than emotion – that is, it is governed by the cerebral cortex rather than by subcortical structures, as is the case with primates. Humans do not need to experience intense emotional arousal in order to speak; a mere act of will suffices. In our view, this capacity – the conscious control of speech – is not merely a physiological or psycholinguistic trait, but a profound scientific insight into the essence of human communication. It is precisely this volitional element that gives rise to the intentionality of utterances, their semantic precision, and their adaptability across a wide range of communicative contexts, from interpersonal dialogue to complex professional and academic discourse. We consider the intentional nature of speech to be one of the most critical distinguishing features of human beings.

For all of these adaptive features to operate effectively, they must be coordinated by a central system: the brain (Kapitan, 2017). At the same time, the volitional control of language is inextricably linked to the unique functionality of the human brain – especially its capacity to form associative connections. The brain's ability to interlink “everything with everything” allows us, for instance, to read and imagine what is described in text as though we were perceiving it directly with our senses. As a result of neural interactions that encode distinct aspects of a concept within the brain, humans are able to establish meaningful associations between linguistic signs, enabling rich, flexible, and contextually embedded language use.

Conclusions. In light of the foregoing, we conclude that language emerged as a response to the need for organizing knowledge, shaping collective experience, and regulating social interaction. In summary, the evolution of language – from mythological narratives to formalized writing – represents a complex, multilayered process that reflects not only technological advancement but, more importantly, the intellectual and social maturity of humankind. In our view, language functions as an instrument of collective

memory, enabling not only the intergenerational transmission of information but also its structural interpretation.

Thus, the ability to encode knowledge, generate abstract concepts, and preserve cultural experience positions language as a central driver of both individual development and civilizational progress. Language, therefore, should be understood not merely as a communicative tool but as a profound cognitive phenomenon shaped by evolution and embedded within a sociocultural context. Its uniqueness arises from the combination of core features identified in the works of Charles Hockett and supported by contemporary cognitive scientists – namely, semanticity, openness, displacement, cultural transmission, discreteness, prevarication, and reflexivity. These properties enable language to perform not only communicative, but also epistemic, conceptual, and reflective functions.

As such, human speech differs fundamentally from animal communication systems: it is not an instinctive repertoire of reactions, but a socially acquired, culturally transmitted, and consciously regulated behavior. Anatomical prerequisites – such as the structure of the vocal tract – along with neurophysiological mechanisms and volitional control over speech, provide the physical foundation for the production of complex linguistic forms. At the same time, the sociocultural environment infuses language with semantic depth, pragmatic relevance, and symbolic value.

Therefore, the development of language should be viewed not solely as a consequence of biological evolution, but above all as the result of an ongoing interaction between cognitive processes and sociocultural factors. This interaction opens up the uniquely human capacity to comprehend the world through language – to describe, analyse, reinterpret reality, preserve collective memory, and construct new meaning. We thus conclude that language evolution, viewed through a sociocultural lens, is the key to human cognition, as it is language that structures our thinking, enables us to navigate abstraction, and facilitates the transmission of knowledge across time, cultures, and experience.

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Ю. Пришупа

МОВНА ЕВОЛЮЦІЯ В СОЦІОКУЛЬТУРНОМУ ВИМІРІ ЯК КЛЮЧ ДО ЛЮДСЬКОГО ПІЗНАННЯ

Резюме

У статті здійснено комплексний аналіз мови як еволюційного та соціокультурного феномена, що виконує ключову роль у формуванні пізнавальної діяльності людини. Автор розглядає мовлення не лише як засіб комунікації, а як глибинну систему осмислення реальності, що поєднує біологічні, ментальні та культурні чинники. Проведено огляд основних властивостей мови, зокрема семантичності, відкритості, культурної спадкоємності, переміщуваності, дискретності, ухильності та рефлексивності, що у своїй сукупності забезпечують здатність мови структурувати знання, моделювати уявлення про світ і здійснювати рефлексивний аналіз дійсності. Розкрито взаємозв'язок між здатністю до мовної рефлексії та формуванням вищих когнітивних процесів, що засвідчує унікальну роль мови в еволюції свідомості.

Особливу увагу приділено порівнянню мовної системи людини з комунікативними сигналами тварин, що дозволяє виявити критичні відмінності між біологічно обумовленими системами та свідомо контрольованим мовленням. Автор аргументує, що мова розвивалася не лише як результат еволюції фізіологічних механізмів (зокрема будови гортані та мовленнєвого тракту), а й як соціокультурне надбання, сформоване в процесі навчання, взаємодії та передачі досвіду. Вказується на ключову роль культурного середовища у формуванні мовної картини світу, а також на когнітивні механізми, які забезпечують здатність мови адаптуватися до нових умов, змістів і комунікативних завдань. У такий спосіб мова розглядається як результат багатовекторного розвитку, де біологічне і соціальне невіддільно переплетені у формуванні людського пізнання.

Мета дослідження полягає в теоретичному обґрунтуванні та аналітичному огляді людської мови як основи пізнання, її анатомічних, когнітивних і соціокультурних передумов.

Завдання дослідження зосереджені на науковому визначенні комплексу мовних властивостей, що забезпечують її пізнавальний потенціал, і довести нерозривний зв'язок між мовним розвитком і формуванням людського мислення.

Висновки. Підсумовуючи результати дослідження мовної еволюції в соціокультурному вимірі, автор доходить висновку, що мова є фундаментальним інструментом не лише комунікації, а передусім пізнання та концептуалізації дійсності. На відміну від тваринних сигналів, людське мовлення має гнучку, продуктивну й усвідомлену природу, що дозволяє формувати абстрактні смисли, будувати складні висловлювання, висловлювати емоційно-вольові стани, створювати наукові моделі та здійснювати рефлексію над власною мовною діяльністю. З огляду на соціокультурний контекст, у якому формується мовна здатність, наголошується на важливості середовища, традицій і навчання як чинників, що визначають мовну картину світу кожної спільноти. Крім того, дослідження підтверджує важливу роль анатомо-фізіологічних і нейрофізіологічних передумов – контроль дихання, мобільність артикуляційних органів, здатність до вольового мовлення – у формуванні мовної компетентності. Таким чином, мова постає як багатовимірне явище, в якому переплітаються біологічна еволюція, когнітивні механізми й соціокультурні впливи, що разом забезпечують розвиток людського мислення, пізнання та передачі досвіду, підтверджуючи досягнення мети дослідження.

Ключові слова: мовна еволюція; соціокультурний вимір; властивості мови, пізнавальна діяльність людини.

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ФОРМУВАННЯ КОМУНІКАТИВНОЇ КОМПЕТЕНТНОСТІ У МАЙБУТНІХ ФІЗИЧНИХ ТЕРАПЕВТІВ ЗАСОБАМИ МІЖДИСЦИПЛІНАРНОГО ПІДХОДУ

Резюме

У статті розглянуто проблему формування комунікативної компетентності у студентів спеціальності «Фізична терапія» в контексті застосування міждисциплінарного підходу до організації освітнього процесу. **Мета дослідження** – обґрунтувати педагогічні умови ефективного формування комунікативної компетентності майбутніх фахівців з фізичної терапії шляхом інтеграції знань і навичок з різних дисциплін. **Завдання дослідження:** визначити сутність поняття «комунікативна компетентність» у професійному контексті фізичного терапевта; проаналізувати існуючі підходи до її формування у вищій освіті; дослідити потенціал міждисциплінарної інтеграції в освітніх програмах; обґрунтувати дидактичні умови та методи реалізації міждисциплінарного підходу; виявити ефективні практики формування професійної комунікації у студентів. **Методи дослідження:** 1) теоретичні – аналіз наукової літератури, педагогічне моделювання, систематизація, узагальнення; 2) емпіричні – спостереження за