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Developing Language Competence in Biology through Learning Russian

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Abstract. *This article explores the integration of Russian language instruction into biology education as a strategic approach to enhance students' scientific and linguistic competence simultaneously. Drawing on interdisciplinary methods such as Content and Language Integrated Learning (CLIL), the paper emphasizes the pedagogical benefits of contextualizing biology instruction within the framework of Russian-language acquisition. It highlights how task-based learning, authentic text exposure, multimodal instruction, and language-sensitive assessment strategies can deepen students' grasp of both biological concepts and academic Russian. Furthermore, the article addresses the sociolinguistic, cognitive, and institutional implications of bilingual science education in post-Soviet and multilingual regions, advocating for cross-disciplinary teacher training and systemic curricular support. By fostering dual literacy in science and language, the model prepares learners for higher education and global scientific participation.*

Key words: *Biology education, Russian language learning, CLIL, bilingual instruction, language competence, scientific literacy, interdisciplinary teaching.*

INTRODUCTION

In the modern educational landscape, the integration of language learning with subject-specific instruction has become a pivotal concern, especially in multilingual and multicultural academic environments. As global mobility increases and interdisciplinary education gains prominence, the ability to access and process scientific information in multiple languages has transformed from a mere advantage into a necessary skill. Within this context, developing language competence in biology—a complex, terminology-rich discipline—through the study of the Russian language represents a promising pedagogical strategy with cognitive, communicative, and academic benefits.

MATERIALS AND METHODS

Russian remains one of the major scientific languages, particularly in the post-Soviet educational sphere, where a vast repository of biological research, textbooks, and instructional materials exists in Russian. For students in Central Asia, Eastern Europe, and other former Soviet regions, the ability to read, understand, and communicate biological concepts in Russian is not only historically and regionally relevant but also practically enriching. Moreover, Russian as a medium of instruction or academic communication in biology enables students to engage with original research publications, collaborate internationally, and access a wealth of technical vocabulary and conceptual frameworks that may not yet be translated into their native languages.

RESULTS AND DISCUSSION

The process of developing language competence in biology through Russian must begin with a recognition that both language and scientific understanding are constructed simultaneously, particularly in early-stage learners or non-native Russian speakers. The learner is not merely acquiring vocabulary or grammatical forms, but is conceptualizing biology itself through a new linguistic lens. Therefore, the pedagogical approach should not be limited to translation or memorization of terms but should emphasize contextual learning, functional communication, and disciplinary discourse.

To achieve this, the application of Content and Language Integrated Learning (CLIL) methodology has proven particularly effective. CLIL advocates for the simultaneous development of subject knowledge and language skills by embedding linguistic objectives into biology lessons. For example, while teaching a topic such as cellular respiration, instructors might integrate activities focused on the correct usage of terms like "митохондрия" (mitochondrion), "энергетический обмен" (energy metabolism), or "анаэробный процесс" (anaerobic process), encouraging students to use these in structured oral or written explanations.

Moreover, task-based learning can be utilized to develop communicative competence in Russian while reinforcing biological content. Activities such as constructing concept maps, analyzing scientific diagrams, or conducting simple laboratory experiments can be accompanied by structured language tasks: describing observations in Russian, writing laboratory reports, or debating hypotheses using subject-specific terminology. In this way, students not only learn the scientific method but also gain the linguistic tools to articulate their reasoning in a clear and academically appropriate manner.

Another critical aspect involves scaffolded reading of authentic scientific texts in Russian, including school-level textbooks, journal articles, or encyclopedia entries. Initially, learners may require glossaries, bilingual dictionaries, or side-by-side translations to decode complex structures. However, with continued exposure, students begin to internalize the syntax, collocations, and genre-specific conventions of scientific Russian. Teachers should guide students through pre-reading and post-reading activities that include summarization, discussion, vocabulary work, and critical questioning to promote deeper engagement with both the content and the language [1].

Pronunciation and listening skills can be honed through multimodal instruction, using Russian-language videos, podcasts, and interactive simulations that present biological phenomena in visually and aurally rich formats. Listening to a Russian-speaking biologist explain ecological succession or watching an animated video about DNA replication in Russian not only supports comprehension but also builds phonological familiarity and confidence in listening to academic Russian.

Assessment strategies in such integrative instruction should be dual-purpose, evaluating both biological understanding and linguistic proficiency. This might involve oral presentations in Russian on a biological topic, short essays or written reflections that demonstrate use of discipline-specific lexis, or formative tests that combine content recall with appropriate language use. Importantly, the evaluation should emphasize clarity, accuracy, and the ability to reason scientifically in Russian, rather than linguistic perfection alone.

From a psychological and sociolinguistic standpoint, learning biology through Russian can also promote academic motivation and intercultural competence. For students from Turkic-speaking or other non-Slavic backgrounds, gaining fluency in Russian allows for smoother academic transitions, access to regional higher education institutions, and broader participation in international conferences and scientific networks. Simultaneously, exposure to the cultural and intellectual heritage embedded in Russian scientific tradition deepens students' appreciation of diversity in thought and expression [2].

Teacher training is a decisive factor in the success of this integrative model. Educators must be proficient in both Russian language and biology, capable of switching between content facilitation and language support roles. They must also be equipped with methodological tools for language-

sensitive biology teaching, including the use of visual aids, language scaffolds, cooperative learning structures, and differentiated instruction tailored to varying levels of language proficiency.

Furthermore, curricular and institutional support is needed to sustain such programs. This includes the development of bilingual or Russian-medium biology textbooks with pedagogical annotations, professional development programs for CLIL instructors, and collaboration with linguists and subject specialists to ensure the accuracy and accessibility of teaching materials.

Beyond linguistic and academic outcomes, teaching biology through Russian offers significant cognitive benefits for learners. Research in bilingual education consistently highlights that learning content in a second language strengthens executive functions, particularly working memory, cognitive flexibility, and attentional control. In the biology classroom, these benefits manifest in students' ability to manage complex information, shift between symbolic systems (e.g., visual, verbal, and numerical representations), and sustain focused attention while navigating unfamiliar linguistic structures [3].

Moreover, bilingual instruction fosters higher-order thinking as students must process, interpret, and express scientific ideas not just in conceptual terms but within the structure and constraints of a non-native language. This dual cognitive load, when properly scaffolded, trains learners to approach problems more analytically and with greater metacognitive control. In essence, students are constantly operating at the intersection of language awareness and scientific reasoning, which deepens both domains.

An important phenomenon in bilingual subject education is cross-linguistic transfer—the ability to apply skills and knowledge from one language to another. In the case of Russian and biology, students frequently encounter morphologically rich terminology where Latin or Greek roots are common across languages, aiding recognition and comprehension. Terms such as photosynthesis (фотосинтез), ecosystem (экосистема), or mitosis (митоз) exist in near-identical forms, allowing for a smoother lexical transfer.

However, grammatical structures and syntactic expectations differ significantly between Russian and English or Turkic languages, and this can pose barriers to accurate scientific communication. For example, the use of aspectual pairs in Russian verbs (e.g., исследовать vs исследовать подробно) or case inflections in compound noun phrases demands attention to linguistic precision when constructing scientific explanations.

Teachers should therefore address both surface similarities and deep structural differences, drawing students' attention to false cognates, polysemous terms, and context-dependent meanings. This level of linguistic analysis, when integrated with content learning, develops metalinguistic competence, enabling students to approach new terminology with greater autonomy and confidence [4].

Scientific vocabulary presents one of the most formidable challenges in content-language integrated instruction. In biology, many terms are dense, abstract, and hierarchically organized, often with no direct equivalent in students' native languages. Learning Russian terminology such as одноклеточные организмы (unicellular organisms), наследственность (heredity), or обмен веществ (metabolism) requires not only memorization but also semantic mapping within conceptual frameworks.

Furthermore, repeated exposure to key terms across varied formats—texts, videos, diagrams, and oral discussions—promotes deeper semantic encoding and retention. Teachers must prioritize precision in terminology, as vague or inconsistent usage may lead to conceptual confusion, particularly in disciplines like biology where terminology often encapsulates entire processes or systems [5].

CONCLUSION

In conclusion, the integration of Russian language instruction with biology education offers a dynamic, cognitively enriching, and academically valuable pathway for students in multilingual contexts. Through thoughtful implementation of CLIL strategies, communicative methods, and language-sensitive assessments, educators can foster both scientific literacy and linguistic

competence. In doing so, they prepare students not only for academic success but for meaningful participation in the global scientific community, where multilingualism and cross-disciplinary fluency are ever more vital.

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