



Enhancing Cognitive Competence through Microlearning: a Pedagogical Model

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Abstract. The study presents a pedagogical model for developing cognitive competence in contemporary students enrolled in higher education programmes through the use of microlearning technology. The relevance of the study is determined by the influence of factors characteristic of the digital information age, which contribute to a decline in learners' attention span and their ability to engage effectively in cognitive activity. Cognitive competence is understood as an integrative construct comprising personal (general and subject-specific intellectual qualities), motivational (interest in learning activity and the aspiration for self-development), cognitive (object-related and metacognitive knowledge), and activity-based components (a set of essential skills). The activity-based component, which plays a leading role, is represented by four groups of skills: intellectual, informational, organisational-regulatory, and metacognitive. The implementation of the model requires three pedagogical conditions: activating the potential of modern digital technologies, integrating neurodidactic research results into microlearning, and facilitating students' independent learning activity. Microlearning is regarded as the key instructional tool for developing cognitive competence, as it represents a contemporary educational approach grounded in current neurodidactic research. Within the learning process, microlearning makes it possible to overcome pedagogical difficulties by fostering the development of voluntary attention, concentration, retention of new information, and awareness in learning. The level of cognitive competence development was assessed according to criteria corresponding to its components: emotional-volitional, motivational, knowledge-based, and procedural. The assessment results made it possible to distinguish the following levels of competence development: intuitive-elementary, reproductive-basic, situational-variable, and creative-productive. The proposed pedagogical model can be integrated into foreign language curricula for different groups of learners.

Keywords: cognitive competence, pedagogical model, microlearning, attention management, digital technologies, neurodidactics, foreign languages

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Педагогическая модель развития познавательной компетенции с применением микрообучения

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Аннотация. В исследовании представлена педагогическая модель развития познавательной компетенции у современных студентов высшей школы с применением технологии микрообучения. Актуальность исследования обусловлена влиянием факторов информационно-цифровой эпохи, которые приводят к снижению концентрации внимания и способности обучающихся к эффективной познавательной деятельности. Познавательная компетенция рассматривается как интегративное образование, включающее личностный (общие и предметные интеллектуальные качества), мотивационный (интерес к учебно-познавательной деятельности и стремление к саморазвитию), когнитивный (объектные и метакогнитивные знания) и деятельностный компоненты (совокупность необходимых умений). Деятельностный компонент, выступающий ведущим, представлен четырьмя группами умений: интеллектуальными, информационными, организационно-регулятивными и метакогнитивными. Разработка модели осуществлялась с опорой на системный, деятельностный, личностно-ориентированный и компетентностный подходы. В качестве методологических оснований были определены общенаучные принципы (целесообразности, системности, планирования), принципы обучения иностранному языку (коммуникативности, взаимосвязанного обучения), принципы андрагогики (гибкости, индивидуализации, осознанности, развития образовательных потребностей, совместной деятельности), а также принципы микрообучения (минимизации, порционности, фокусности, регулярности). Реализация модели предполагает соблюдение трёх педагогических условий: активизацию потенциала современных цифровых технологий, интеграцию результатов нейродидактических исследований в микрообучение и фасилитацию самостоятельной учебной деятельности обучающихся. Оценка уровня сформированности познавательной компетенции осуществлялась по критериям, соотнесённым с её компонентами: эмоционально-волевому, мотивационному, знаниевому и процессуальному. Выделены уровни сформированности компетенции: интуитивно-элементарный, репродуктивно-базовый, ситуативно-вариативный и креативно-продуктивный. Предложенная педагогическая модель может быть внедрена в учебные программы дисциплины «Иностранный язык» при работе с различными категориями обучающихся.

Ключевые слова: познавательная компетенция, педагогическая модель, микрообучение, управление вниманием, нейродидактика, иностранные языки

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1. Introduction

The problem of developing cognitive competence in contemporary students is becoming increasingly relevant in the context of the widespread digitalisation and technologisation of modern society and education. The importance of this issue is emphasised in the key regulatory and strategic documents of the Russian Federation that define the vector of further development of education in Russia. In particular, the state programme of the Russian Federation “Development of Education” highlights the need to improve the effectiveness and quality of education in accordance with contemporary challenges and realities, which implies the introduction of new pedagogical approaches.

The federal programme “Priority 2030” identifies the training of competitive professionals capable of engaging in research and innovation as one of the key objectives of higher education institutions. Achieving this goal requires well-developed competences in learning and cognitive activity, as well as the ability to work effectively with information in a digital environment. These requirements are also reflected in the Federal State Educational Standards of Higher Education, which include among the universal competences the ability for systemic and critical thinking, information search, analysis and synthesis, as well as self-organisation and self-development. Another important foundation is the concept of lifelong learning, established in the Federal Law “On Education in the Russian Federation” No. 273-FZ and the Concept for the Development of Adult Continuing Education (2021). These initiatives emphasise the need to create conditions for continuous professional and personal development, which requires specialists to possess well-developed skills for effective learning and cognitive activity. At the international level, UNESCO¹ and the Council of Europe² have also emphasised the importance of innovative educational approaches that enhance learner engagement, knowledge retention, and skill acquisition.

Drawing on the work of contemporary researchers such as Belozertsev³, Zeer (Zeer, 2011), Sergeev and Blinov (Sergeev & Blinov, 2007) and Zimnyaya (Zimnyaya, 2009), cognitive competence in this study is defined as a complex personal and activity-based construct that encompasses the personal qualities, motivations, knowledge, skills, and experience necessary for effective learning and cognitive activity within the information-digital environment. In the context of this research, the term «information-digital environment» refers to two key characteristics of the modern social and educational context. The digital component relates to the use of digital technologies and resources, while the informational component reflects the abundance of information and the vast, often uncontrolled volumes of data that individuals – and students in particular – encounter on a daily basis. Such an environment inevitably affects the brain’s cognitive processes and, consequently, alters patterns of interaction with information, influencing attention and the retention of new knowledge.

The relevance of the problem of developing cognitive competence among contemporary students is also supported by recent research. An illustrative example is a study conducted by King’s College London in 2024⁴. The results indicate that 49% of respondents reported a decrease in their attention span, the majority of whom belonged to the 18–34 age group. Furthermore, 84% of respondents stated that they experience difficulties with concentration to varying degrees, with half of them attributing these difficulties to significant information overload.

¹ International Commission on Education for the Twenty first Century. Education for the twenty first century: Issues and prospects. UNESCO, 1998. URL: <https://unesdoc.unesco.org/ark:/48223/pf0000114766> (accessed 26.02.2026).

² Redecker, C. European framework for the digital competence of educators: DigCompEdu. Publications Office of the European Union, 2017. <https://doi.org/10.2760/159770>. URL: https://publications.jrc.ec.europa.eu/repository/bitstream/JRC107466/pdf_digcomedu_a4_final.pdf (accessed 26.02.2026).

³ Belozertsev, E. P., Goneev, A. D., Pashkov, A. G. et al. Pedagogika professional'nogo obrazovaniya [Pedagogy of Professional Education] / ed. by V. A. Slavenin. Moscow: Akademiya, 2004. 368 p.

⁴ Do we have your attention? How people focus and live in the modern information environment. King’s College London. The Policy Institute. The Centre for Attention Studies, Feb. 2022. URL: <https://www.kcl.ac.uk/policy-institute/assets/how-people-focus-and-live-in-the-modern-information-environment.pdf> (accessed 01.03.2026).

In addition, Kiryushina notes a general decline in the learning capacity of modern students (Kiryushina, 2022). As Caldwell emphasises, these challenges are further exacerbated by the constant influx of information, which makes it increasingly difficult to distinguish between relevant and irrelevant content. This situation highlights the need to develop strategies that help limit the volume of incoming information and identify its most significant elements, particularly in the context of the learning process (Caldwell, 2023).

To further examine the relevance of the problem under consideration, we conducted our own survey among students during the autumn semesters of 2023–2024. The study involved students enrolled in higher education programmes, with a total of 46 respondents participating in the survey.

The analysis of the responses showed that more than half of the participants (approximately 55–60%) possess only a superficial understanding of attention management skills, primarily associating them with self-control, memorisation of material, and the ability to concentrate. A considerable number of students reported frequent experiences of boredom and distraction, as well as difficulties maintaining concentration. At the same time, about 40% of respondents believe that they are able to sustain attention for extended periods (60–120 minutes). However, pedagogical observation suggests a different picture: around 60% of students acknowledge experiencing concentration difficulties, the need for frequent breaks, and a tendency toward procrastination.

Among the main distracting factors, respondents identified noise, conversations, fatigue, lack of interest, and the influence of digital media, all of which may reduce the ability to maintain sustained attention.

At the same time, the majority of students (79%) expressed a desire to learn how to manage their attention more effectively, linking this skill to reduced procrastination, increased productivity, and more efficient completion of learning tasks. Approximately 21% of respondents, however, tend to associate attention management primarily with the teacher's role, perceiving the instructor as an external regulator of the learning process.

A positive finding is that a substantial proportion of students demonstrate elements of learning awareness. They emphasise the importance of personal responsibility, intrinsic motivation, and a clear understanding of learning goals. Students also attach particular importance to self-reflection: 89% of respondents consider it an essential component of the learning process, noting its role in analysing the outcomes of their activities, identifying mistakes, and organising their learning more consciously. Overall, the results of this empirical study complement existing research findings and further confirm the relevance of the problem under investigation.

Thus, the data presented above highlight two key points. First, they demonstrate the need to develop cognitive competence in contemporary students in order to ensure effective and sustainable engagement in learning and cognitive activity throughout life in a rapidly changing environment. Second, they indicate the need to improve existing approaches and develop new methods for fostering cognitive competence in students, taking into account the specific features of the information-digital educational environment.

In accordance with this, the following research objectives are formulated:

Research Objective 1: to examine microlearning as a method for developing students' cognitive competence in the context of the information-digital environment.

Research Objective 2: to develop a model for fostering students' cognitive competence through the use of microlearning in the information-digital environment.

2. Material and Methodology

The primary research method used to develop the model of cognitive competence formation was a systematic literature review of regulatory and legal documents, strategic policy papers, and theoretical and empirical studies related to the topic.

To achieve the overall aim and objectives of the study, a systematic review of academic sources was conducted using elements of the PRISMA methodology. The analysis included research on the following topics: methodological approaches to conducting pedagogical research (11 monographs were analysed); the development of competence models in pedagogical studies (21 publications and dissertation studies

were analysed); the development of cognitive competence in learners in higher education (26 research publications and 8 dissertation studies were analysed); and microlearning as a contemporary instructional approach in the information-digital era (abstracts of 119 publications were reviewed in the Scopus database for the period 2019–2026, resulting in a final sample of 16 studies for in-depth analysis).

To examine the theoretical and methodological foundations of pedagogical research, the works of prominent Russian and international scholars were analysed. The studies of Yakovlev and Yakovleva were particularly important for the development of the competence model (Yakovlev, Yakovleva, 2006). The problem of the formation and development of cognitive competence was examined in the works of Sergeev & Blinov (Sergeev, Blinov, 2007), Zimnyaya (Zimnyaya, 2009), Kiryushina⁵, Lavrik (Lavrik, 2018), and Solonina⁶. Microlearning has been addressed in the works of Langreiter & Bolka (Langreiter, Bolka, 2005), Hug (Hug, 2007), Kohnke (Kohnke, 2023), and others.

3. Results

3.1. Scientific approaches and principles

The conduct of any pedagogical study begins with the identification of key research approaches to the problem under investigation. In the present study, the following approaches were selected as the primary methodological foundations: the systemic, activity-based, learner-centred, and competence-based approaches.

The systemic approach was chosen because it views pedagogical phenomena as integrated systems consisting of interrelated elements. Within this study, the model for developing cognitive competence is considered as a pedagogical system characterised by a specific goal, structure, components, and internal relationships, which makes it possible to identify its system-forming factors and the logic underlying its functioning (Yakovlev, Yakovleva, 2006, p. 122).

The activity-based approach is of particular importance for pedagogical research, as it is grounded in the idea that competences are formed through learners' active engagement in various forms of activity. In this study, the development of cognitive competence is understood as a collaborative process involving both instructors and students, implemented through microlearning and a range of methodological tools (Yakovlev, Yakovleva, 2006, p. 74).

The learner-centred approach makes it possible to take into account learners' individual characteristics, educational needs, and motivation⁷. Its application is especially important in the context of adult learners enrolled in higher education programmes. Finally, the competence-based approach enables the study to define the structure and content of cognitive competence and to align it with contemporary requirements of higher education.

A set of principles underlying the development of the model was also identified. At the general methodological level, these include the principles of purposefulness, systematicity, and planning. At the subject-specific level, the principles of communicativeness (Zimnyaya, 1991, p. 22) and integrated language learning⁸ were taken into account. The principles of andragogy relevant to the study include flexibility and individualisation, awareness and the development of learners' educational needs, as well as collaborative learning (Biryukova, 2008). The principles of microlearning — minimisation, segmentation, focus, and regularity — are directly related to microlearning as the primary instructional method of the proposed model. The importance of regular, focused microlearning practices is supported by both theoretical and empirical studies (Hug, 2007).

⁵ Kiryushina, O. V. (2007). *Osnovy diagnostiki spetsial'noy poznavatel'noy kompetentnosti v professional'nom yazykovom obrazovanii* [Foundations of Diagnosing Special Cognitive Competence in Professional Language Education]. Cand. ped. sci. diss. Yekaterinburg. (In Russian)

⁶ Solonina, L. V. (2007). *Razvitie inoyazychnoy uchebnoy kompetentnosti na nachal'nom etape professional'nogo yazykovogo obrazovaniya* [Development of Foreign Language Learning Competence at the Initial Stage of Professional Language Education]. Cand. ped. sci. diss. Yekaterinburg. (In Russian)

⁷ Vishnyakova, S. M. *Professional'noe obrazovanie: Slovar'. Klyuchevye ponyatiya, terminy, aktual'naya leksika* [Professional Education: Dictionary]. Moscow: NMTs, 1999. 538 p. (p. 152)

⁸ Galskova, N. D., Gez, N. I. *Teoriya obucheniya inostrannym yazykam: Lingvodidaktika i metodika* [Theory of Foreign Language Teaching: Linguodidactics and Methodology]. 6th ed. Moscow: Akademiya, 2009. 336 p. (p. 152)

3.2. Pedagogical Model

Within the framework of the systemic approach, the pedagogical object of this study – cognitive competence – is viewed as an integrated construct that can be understood as a pedagogical system. The study employs pedagogical modelling as an appropriate research tool. Following the classification proposed by Yakovlev, the developed pedagogical model can be attributed to the structural-functional type (Yakovlev, Yakovleva, 2006, pp. 124–126). Its structure comprises three interrelated domains: the content domain, the procedural domain, and the assessment and evaluation domain.

1. The content domain describes the structure of cognitive competence, which is represented by four interrelated elements: the personal, motivational, cognitive, and activity-based components. These components were identified with reference to the studies of Kiryushina (Kiryushina, 2007), Lavrik (Lavrik, 2018), and Solonina (Solonina, 2007).

The personal component reflects the degree to which learners possess qualities that support effective cognitive activity, such as goal orientation, independence, initiative, responsibility, organisation, and active engagement. The motivational component characterises the learner's interest in academic activity, readiness to participate actively in the educational process, and aspiration for self-development. The cognitive component includes both object-related and metacognitive knowledge. The activity-based component reflects the level of development of the skills that form the foundation of cognitive competence.

Based on the classification of learning skills proposed by Kolesnikova and Konstantinova (Kolesnikova, Konstantinova, 2006, pp. 97–100), as well as the classification suggested by Galskova⁹, we identified the following groups of skills: intellectual, informational, and organisational-regulatory. The development of these groups is grounded in metacognitive skills, the formation of which is significantly supported by microlearning. These metacognitive skills include: the ability to identify the focus of attention when performing a learning task; the ability to formulate an intention when selecting a learning object; the ability to concentrate on a key learning object or task; and the ability to maintain concentration for a certain period of time.

2. The procedural domain includes three key elements: (1) pedagogical conditions that support the development of cognitive competence; (2) microlearning and the tools used for its implementation; and (3) the stages of cognitive competence development through microlearning within the framework of the pedagogical experiment.

Three key pedagogical conditions were identified: activating the potential of modern digital technologies, integrating neurodidactic research results into microlearning, and facilitating students' independent learning activity. The effective use of digital technologies enhances the efficiency of the learning process and enables the educational environment to better respond to the demands of the contemporary information-digital context (Titova, 2017). Incorporating principles from neurodidactics¹⁰ supports the development of attention, concentration, and memory through microlearning, as confirmed by theoretical (Hug, 2007; Alias, Abdul Razak, 2023) and empirical studies (Al-Zahrani, 2024; Balasundaram et al., 2024; Chamorro-Atalaya et al., 2024). The facilitation of learning activities (Shakhmatova, 2006) promotes learners' autonomy and supports regular engagement with learning materials while maintaining a high level of motivation.

Microlearning was selected as the primary approach for fostering cognitive competence within the framework of the proposed pedagogical model. The founder of the concept, Theo Hug, describes microlearning as a specific form of learning in which educational programmes are designed and organised at the micro level (Hug, 2007, pp. 16–17). Bugakova defines microlearning as a form of instruction in which learning material is presented in small units, each followed by immediate reinforcement through short learning tasks (Bugakova, 2018, p. 71). Prasittichok and Smithsarakarn view microlearning as an

⁹ Galskova, N. D. *Sovremennaya metodika obucheniya inostrannym yazykam* [Modern Methods of Foreign Language Teaching]. 2nd ed. Moscow: ARKTI, 2003. 192 p. (pp. 93–94)

¹⁰ Kostromina, S. N. *Vvedenie v neurodidaktiku* [Introduction to Neurodidactics]. Saint Petersburg: Saint Petersburg University Press, 2019. 180 p.

educational practice based on the use of compact and information-rich learning content that makes it possible to design clear and accessible lessons (Prasittichok, Smithsarakarn, 2024, p. 531). The key concepts of microlearning include focus and needs analysis (Kohnke, 2023, p. 16).

3. The assessment and evaluation domain includes the criteria and indicators used to evaluate the level of cognitive competence, as well as the expected outcomes of implementing the pedagogical model. Assessment is carried out according to four criteria: emotional-volitional, motivational, knowledge-based, and procedural. Four levels of competence development are identified: intuitive-elementary, reproductive-basic, situational-variable, and creative-productive. The expected outcome of the model's implementation is the development of a stable readiness among students to engage effectively in learning and cognitive activities both in classroom settings and in independent study within the information-digital environment.

4. Discussion

The rapid development of digital technologies and artificial intelligence is profoundly transforming the contemporary educational landscape and generating new challenges for both learners and educators. The increasing accessibility of AI tools capable of generating texts, solving complex problems, and instantly providing ready-made answers is reshaping the very nature of learning activities. On the one hand, such technologies expand access to knowledge and open new possibilities for personalised learning. On the other hand, they may reduce students' independent cognitive engagement. Under these conditions, the ability of learners to consciously organise and regulate their own learning processes becomes particularly important.

One of the widely discussed challenges of the digital era is the weakening of memory, attention, and the capacity for deep information processing. In academic and popular discourse, this phenomenon is often associated with the concept of digital dementia¹¹. Continuous interaction with short-form content, habitual switching of attention, and reliance on instant access to information may reduce the ability to sustain concentration, engage in analytical thinking, and retain information meaningfully (Mineva, 2021). Consequently, the development of self-regulation skills, attention management, and conscious engagement in cognitive activity becomes increasingly important.

In this context, particular significance is attached to the development of the so-called learning to learn competence, widely recognised as one of the key meta-competences. In the present study, this ability is examined through the concept of cognitive competence, which includes personal, motivational, cognitive, and activity-based components. Future research may also consider incorporating a meta-digital component into the structure of cognitive competence as a distinct group of skills. As noted by Konkol and Marina, the development of meta-digital competence is essential in the context of the information-digital era, as it fosters the ability to engage consciously and critically with artificial intelligence as an educational tool (Konkol, Marina, 2025).

The development of cognitive competence becomes especially important in the context of adult education. Adult learners typically combine their studies with professional responsibilities, which requires a high degree of autonomy and self-regulation. According to the principles of andragogy (Biryukova, 2008), adult learners tend to be oriented toward practical outcomes and rely on their prior experience. Therefore, the development of cognitive competence becomes an essential condition for successful adult learning and for the implementation of the concept of lifelong learning.

In recent years, increasing attention has been paid to teaching approaches aimed at activating cognitive processes. Among these, microlearning has gained particular prominence. As noted by Langreiter and Bolka, microlearning reflects the growing fragmentation of informational resources and learning processes, particularly in rapidly evolving fields (Langreiter, Bolka, 2005, p. 79). Similarly, Stracqualursi and Agati position microlearning alongside other contemporary educational approaches such as adaptive learning, immersive learning, and gamification (Stracqualursi, Agati, 2024).

¹¹ Hansen, A. Na tsifrovoy igne [Hooked on Screens] / transl. from Swedish by I. N. Petrova. Moscow: RIPOL klassik, 2021. 240 p.

According to Lalitha and Sreeja, microlearning is characterised by brevity, clearly defined learning objectives, multimodal learning content, just-in-time learning, repetition and reinforcement, as well as mobile accessibility (Lalitha, Sreeja, 2024, p. 231). Furthermore, Souza and Amaral note that media resources are frequently used in microlearning practices when working with microcontent (Souza, Amaral, 2014, p. 675). Experimental studies demonstrate that microlearning can be effectively implemented through a wide range of digital technologies: Conde-Caballero and colleagues explored microlearning through TikTok in undergraduate education (Conde-Caballero et al., 2024), while Gorham and colleagues presented a microlearning-based model for developing peer-assessment skills (Gorham et al., 2023).

From a neurodidactic perspective, microlearning also contributes to the development of metacognitive skills related to attention management, concentration, and the self-regulation of learning activities (Lykova, 2025). In this sense, microlearning can be considered not only a way of organising learning content into compact units but also a means of fostering a more conscious and autonomous approach to learning. Overall, the ongoing digital transformation of education highlights the importance of developing cognitive competence among learners, and microlearning appears to be a promising pedagogical tool that aligns with the principles of andragogy and supports the development of the skills necessary for effective learning and lifelong education.

5. Conclusions

The present study addressed the research objectives outlined at the beginning of the paper. Microlearning was examined and proposed as a key method for developing cognitive competence within the framework of the pedagogical model presented in this study. The proposed model focuses on the development of cognitive competence among students enrolled in higher education programmes. It incorporates microlearning as its central methodological component and aligns with the demands and characteristics of learning in the contemporary information-digital environment. The proposed model contributes to the theoretical understanding of cognitive competence development in the context of digital education and offers practical guidance for integrating microlearning into educational practice. Its implementation may enhance students' ability to organise and regulate their learning activities effectively in the contemporary information-digital environment and support the development of competencies necessary for lifelong learning.

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Conflict of Interest

The author declares no conflict of interest.

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