

# МЕТОДОЛОГІЧНІ ПРОБЛЕМИ ВПРОВАДЖЕННЯ ЦИФРОВИХ ТЕХНОЛОГІЙ ТА ІННОВАЦІЙНИХ МЕТОДИК НАВЧАННЯ

УДК 378.014.147:[81·243:51]

DOI: 10.31652/2412-1142-2024-73-5-14

## **Gromov Ievgen Volodymyrovych**

Doctor of Arts in Pedagogy, Full Professor, Head of Research and Development Department,  
Professor at the Department of Pedagogics, Professional Education and Educational Institutions Management,  
Vinnytsia Mykhailo Kotsiubynsky State Pedagogical University,  
Vinnytsia, Ukraine

ORCID ID: 0000-0002-0234-606X

*yevhen.hromov@vspu.edu.ua*

## **Kolomiets Alla Mykolaivna**

Doctor of Arts in Pedagogy, Full Professor, Vice-Rector in Scientific Activity,  
Professor at the Department of Pedagogics, Professional Education and Educational Institutions Management,  
Vinnytsia Mykhailo Kotsiubynsky State Pedagogical University,  
Vinnytsia, Ukraine

ORCID ID: 0000-0003-0536-0147

*alla.kolomiets@vspu.edu.ua*

## **Hordiienko Yulia Anatoliivna**

Master of Arts in Pedagogy, Postgraduate Student at the Department of Pedagogics, Professional Education and  
Educational Institutions Management,  
Vinnytsia Mykhailo Kotsiubynsky State Pedagogical University  
Vinnytsia, Ukraine

ORCID ID: 0000-0003-3084-4434

*yuliiahordiienko1984@gmail.com*

## DEVELOPMENT OF THE FUTURE MATHEMATICS TEACHERS' FOREIGN LANGUAGE TRAINING TECHNOLOGIES IN THE CONDITIONS OF EDUCATIONAL GLOBALIZATION

**Abstract.** The article considers the issue of development the effective technologies of foreign language training of future mathematics teachers in the modern conditions of educational globalization. The authors state that the essence, structure and content of foreign language preparation of pedagogical university students majoring in Mathematics differ significantly from the foreign language training of students majoring in philological disciplines. It is shown that foreign language training should not be reduced only to learning a foreign language, it is a much more complicated process which includes different facets of foreign language training, in particular: educational, cognitive, developmental, upbringing aspects. In the context of this research, the authors define foreign language preparation of Mathematics students as a set of special knowledge, abilities, skills, qualities and behavioral norms that ensure the future teachers' ability to effectively fulfil professional duties using foreign languages in the conditions of globalized educational environment. The result of this training is regarded as possession of the high level of readiness of the Mathematics students for their future effective professional activity in the conditions of educational globalization. The authors also determined the main criteria for the formation of the Mathematics teachers' readiness for living and fulfilment of professional activity in the conditions of educational globalization, namely: value-motivational, cognitive-informational, operational, scientific-research, professional-reflective. The authors based their research on the generalization, systematization, and juxtaposition of international and domestic experience of foreign language education of the pedagogical students majoring in both philological and non-philological disciplines. Based on this analysis, the authors elaborated the structural-functional model which may be applied in the process of foreign language training of pedagogical university Mathematics students in the conditions of educational globalization.

**Key-words:** educational globalization, foreign language training, future mathematics teacher, formation of readiness, structural-functional model.

## 1. INTRODUCTION

The modern world and European trends concerning the sphere of foreign language education demonstrate existing interrelation of the phenomena which require at least upper intermediate level of foreign language competency. They are globalization, informatization, and cross-cultural interdependence. These processes unavoidably cause: increasing of the information stream volumes; reinforcement of international cooperation; globalizing of economical relations; swift developments in the sphere of ICT; and the need for effective cross-cultural communications. Proficiency in foreign languages, primarily English, is now regarded as a serious competitive advantage. These processes consequently influence the crucial spheres of human existence: innovations in science, developments of technical means, economic and employment issues, social relations etc. The significant increase of quantity of foreign students seeking for obtaining international higher education degrees and mastering foreign languages in order to use them practically both in their own country and abroad is also an additional factor to the issue.

Within the EU educational policy, there is the crucial necessity of mastering two or more widely spread foreign languages. The English language proficiency is traditionally regarded as a «must have» skill for communication both in Europe and around the globe. It is not only a marker of a well-educated person but is also considered an important tool for developing of so-called «European identity». An Action Program of the European Union in the Field of Lifelong Learning also gives special attention to communicative competency in foreign languages. In this document learning of foreign languages is regarded as an important interdisciplinary aspect piercing through all stages of studying [7].

Realization of the Common European Framework of Reference for Language (CEFR) necessitates thorough revision of the established views on the process of forming the future non-philological teachers' foreign language skills, counting the needs of modern society and the requirements for the level and scope of knowledge that every pedagogical higher education institution graduate must possess [27]. Therefore, there is an urgent need to bring the process of training future teachers in line with modern demands. This shift in the educational paradigm foresees the transition from traditional to innovative ways of professional development of a person, from the priority of highly specialized tasks to the integral development of the future teacher's personality, pedagogical interaction, cooperation and co-creation. This will ensure the forthcoming successful integration of Ukraine into the European scientific and educational space.

Adopted by the Ukrainian government, the National Foreign Language Learning and Promotion Initiative foresees proficiency of every Ukrainian school graduate in at least two foreign languages [10]. This requires the teachers' ability to implement innovative teaching methods, to ensure constant improvement (and self-improvement) of the student's personality. The purpose of pedagogical higher education is to train a highly educated specialist and a creative worker who is capable of working in a multilingual information space. Teaching children, shaping their worldview and culture, the modern teacher educates the young generation to live and work in the EU's multicultural interaction conditions. This changes the historical mission of a teacher, whose main task now is upbringing the need and ability to live together in a single European home, exercising the principles of democracy, legality, peacefulness, solidarity, security, tolerance, equality, and respect for human rights.

The implementation of these tasks requires a unified development strategy for future teachers' foreign language training, subordinated to the idea of integration of the new generation of teachers on a single platform of European values, simultaneously counting the peculiarities and specificities of the national cultures and characters.

**Problem setting.** Ukraine is making considerable efforts to update the foreign language training content and improve its methodology in accordance with the significant social and technological transformations taking place both in Ukraine and in the world. For many years, scholars have been researching topical issues of the future teachers' foreign language training in various directions. The research analysis shows that the main attention has so far been paid to the

study of foreign languages future teachers' professional training peculiarities, while the specificities of the foreign language training of the pedagogical university students majoring in Mathematics have not yet become the subject of a separate holistic scientific study.

**The aim of the study.** Taking into account the rapid development of Eurointegrative trends in Ukraine, the longing to join the European space of higher education, the social significance of ensuring the quality and efficiency of future mathematics teachers' foreign language training, the lack of both comprehensive systematic study and practical implementation of the European experience in the sphere of foreign language training of the future Mathematics teachers, the urgency of the problem, as well as its social significance and insufficient development in domestic pedagogy, the aim of our research is *to develop an efficient model of the future mathematics teachers' foreign language training in the conditions of educational globalization*. The study is based on the generalization, systematization, and juxtaposition of both international and domestic experience of foreign language education of the pedagogical students majoring in both philological and non-philological disciplines.

## 2. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

Actually, the phenomenon of «educational globalization» is often regarded as a complex and quickly developing entity that is strongly influenced by the combination of global socio-economic, legislative-political, and ethno-cultural factors. This phenomenon has been the subject of scientific investigations by Ukrainian (V. Andrushchenko, N. Avshenyuk, V. Kremen, A. Sbruyeva, I. Zyazyun) [1; 2; 15; 21; 36] and foreign scholars (T. Clayton, H. Daun, A. Giddens, P. Jarvis, B. Lingard, L. Sklair, A. Welch) [4; 6; 11; 13; 22; 31] for many years. The notion itself was included in the pedagogical terminological apparatus at the millennium turn, in particular, to define the processes having a significant influence on making strategic decisions on reforms in «traditional» educational systems of different states in the context of educational globalization increase.

In the era of global educational concept change, the internationalization of higher pedagogical education, may become an efficient tool for securing a competitive level of proficiency in the educational services market. This statement refers to both the separate HEIs and the Ukrainian national educational system at large [12, p. 445].

The positive features of higher education internationalization are easy to be seen: pooling of both educational and R&D resources (especially, inaccessible and/or expensive ones); avoidance of research topics doubling; knowledge universalization; alleviation of access to higher education; introduction of international standards for the quality of higher education; higher education innovativeness increase; extension of international cooperation in the spheres of education and R&D; strengthening scientific and educational contacts; intensification of academic mobility ratio; expanding R&D boundaries; enrichment of curricular; and enhancing the knowledge stock of all the actors in the educational process. Scholars-representatives of different countries working in the Ukrainian HEIs expand cross-cultural ties of both foreign guests and local dwellers. Admission of foreign students guarantees additional level of development in the cross-cultural competency, and therefore significantly contributes to mutual understanding and political stability.

The main objectives of the Ukrainian national strategy for internationalization of higher education are as following:

- Increasing the level of Ukrainian HEIs' competitiveness in the fields of education and R&D;
- Expanding the opportunities for Ukrainian HEIs to join the global educational market;
- Playing more active role in the European higher education system development;
- Introducing Ukraine as a potent actor on the European market of educational services;
- Raising the level of institutional and R&D infrastructure to the European standards.

Internationalization of the Ukrainian HE system facilitates to:

- Increasing currency income at the expense of the foreign students' tuition;
- Enriching curricula via partial including programs of the partner foreign HEIs;
- Raising the effectiveness via using pooled educational and R&D resources;
- Securing the high quality level of education and R&D via mutual knowledge exchange.

In the context of our research, we define foreign language training of the future teachers of Mathematics within globalized educational environment as a set of special knowledge, abilities, skills, qualities and behavioral norms that ensure the teachers' ability to effectively fulfil professional duties using foreign languages. Since the training of students for professional activity within globalized world cannot be limited only to mastering the procedural component of major specialty, it is also necessary to purposefully form and develop professional and personal qualities that (in future) should ensure the maximum satisfaction of various population segments representatives with the quality of provided educational services.

### **3. RESEARCH METHODS**

The core hypothesis of the study is that the success of Ukraine's introduction into the area of European education is determined by the processes of modernization of the national education system, particularly the foreign language training of future mathematics teachers, designed to prepare a new generation of specialists, competitive and ready for new transformational changes. The system of foreign language training of pedagogical personnel must meet the requirements of the Ukrainian society, the logic and methodology of modern pedagogical science; must be based on the theories of individual and societal cultural development; organically integrate into the general theory of learning; to provide opportunities to solve cultural, sociological, psychological and pedagogical problems. Based on a thorough analysis of various foreign and domestic research regarding the essence, structure and content of foreign language training of future mathematics teachers, the structural-functional model of this training in the conditions of educational globalization can be generalized and systematized.

### **4. RESEARCH RESULTS AND DISCUSSION**

In Ukraine, foreign language training is legally recognized not only as a mandatory component of any professional education but also as a crucial constituent component of higher education in the conditions of societal globalization and informatization; a powerful factor that ensures harmonious interaction with a multicultural, globalized and competitive world; as one of decisive means of increasing the native specialists' competitiveness. However, in Ukrainian sources we did not find a clear definition and description of the structure of foreign language training of pedagogical students majoring in mathematics in the conditions of educational globalization. In general, Ukrainian scholars sometimes equate foreign language training with foreign language education, or simply with the study of foreign languages [28, p. 128; 29, p. 301; 24, p. 191]. In the majority of Ukrainian studies, the formation of foreign language competence is defined just as the result of foreign language training [3, p. 160; 14 p. 57; 19, p. 81; 26, p. 83; 34, p. 235; 35, p. 211].

Supporting N. Sura's opinion that foreign language training cannot be withdrawn from the future specific major specialty of today's students, we would like to point out that foreign language training can not be narrowed only to learning a foreign language [25, p. 297]. At this point, we are more inclined to agree with O. Khomenko that in the epoch of globalization and integration into the European and world political, economic, cultural, and educational spaces, for any Ukrainian specialist it is crucial not only to master foreign languages but also unambiguous understanding main cultural characteristics of different peoples and countries. The capability to communicate in foreign languages belongs to general and professional competencies, the synthesis of which determines the specialists' qualifications [14, p.55-56].

The article by K. Pavelkiv presents the most detailed analysis of the general characteristics of the factors and principles of foreign language training of non-philological students in the system of pedagogical university. The researcher not only outlines the specifics of the domestic theory and methodology of specialists' foreign language training, but also substantiates the leading contradictions that arise in foreign language training in the sphere of higher pedagogical education. The author defines the clue competencies that are formed during foreign language training as: the ability to acquire knowledge, the ability to search, and the ability to develop the level of one's thought processes. Cooperation skills, the ability to fulfil professional activity, and the ability to social adaptation are also in the list [19, p. 80].

Having completed an additional analysis of research by European scientists (W. Cockiewicz, Z. Dzięgielewska, S. Eaton, S. Hanušová, E. Lipińska, W. Miodunka, P. Najvar, M. Pawlak, M. Pišová, J. Štefflová, K., Vlčková P. Wolski, W. Wilczyńska) on the essence, content and structure of foreign language training of future teachers majoring in non-philological disciplines, we came to the conclusion that for successful carrying out their professional activity in the globalized world, modern teachers of mathematics need intercultural competence, for the formation of which it is not enough just to know foreign languages [5; 8; 9; 16; 17; 18; 20; 23; 30; 32; 33].

They need to possess pedagogically formed readiness for:

- Intercultural communication;
- Professional activity in the foreign language environment;
- Adaptation to different socio-cultural conditions;
- Self-directed education using foreign language sources of scientific information;
- Determination of effectiveness and expediency of bilingual education.

It is obvious that such readiness may be regarded as an integrated, solid and dynamic characteristic of a modern teacher who lives and works in the globalized world; as an indispensable condition for the successful fulfilment of professional activities in a multicultural educational environment; and as a sufficient level of mobilization the teachers' internal reserves for the purpose of organizing the processes of both education and self-education in a foreign language environment.

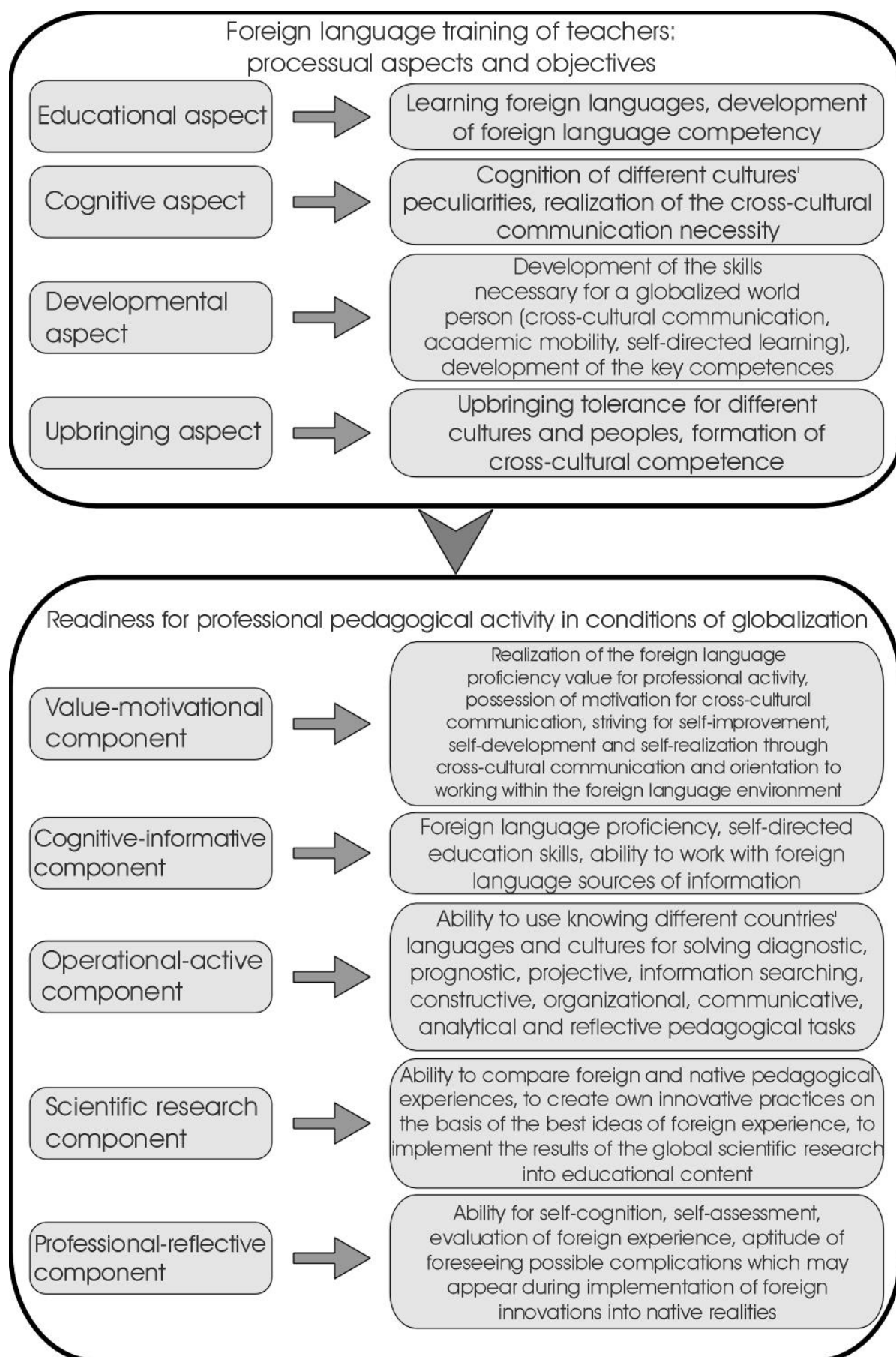
This readiness can be formed using the model of foreign language training, which would not be limited just to traditional study of foreign languages, but would present a wider concept which includes four different aspects of foreign language education. They are:

- Aspect of education (learning foreign languages, developing foreign language competence);
- Aspect of cognition (learning the distinctive peculiarities of different cultures, awareness of the necessity to carry out cross-cultural communication);
- Aspect of development (development of personal cross-cultural communicative capability, self-education, attainment of key linguistic competencies, realization of academic mobility);
- Aspect of upbringing (encouraging tolerant attitude to different cultures and nationalities, acquisition of cross-cultural competence).

However, the educational aspect is only a separate aspect of foreign language training. In our opinion, in this framework, the other three aspects are more important for a teacher working in a globalized world.

Summarizing the mentioned above scientific publications on the problem of structuring readiness for intercultural communication, based on scientific approaches to the problems of pedagogical communication, we define the main criteria for the formation of mathematics teachers' readiness for effective work in the conditions of educational globalization. They are:

- Value-motivational criterion, which presumes awareness of the foreign language proficiency value for professional activity, possession of motivation for cross-cultural communication, striving for personal improvement, personal development and personal realization through the cross-cultural communicative actions and orientation at existence within the foreign language environment;
- Cognitive-informative criterion, which presumes possession of foreign language proficiency, self-directed education skills, capability to operate information presented in other languages;
- Operational-active criterion, which presumes the ability to use knowing different countries' languages and cultures for solving tasks connected with searching and processing data, as well as carrying out pedagogical assignments of constructive, projective, prognostic, analytical, reflective and diagnostic nature;
- Scientific research criterion, which presumes the capability to juxtapose foreign and local pedagogical experiences, to establish own innovative practices based on the best European ideas and examples, to implement the achievements of global scientific research into educational content;
- Professional-reflective criterion, which presumes the ability of foreign experience evaluation, skills of self-assessment and personal cognition, aptitude of foreseeing and overcoming probable complexities which can appear during implementation of foreign innovations into native realities.



**Figure 1.** Structural-functional model of the foreign language training of pedagogical students majoring in mathematics in conditions of educational globalization

As our practice shows, the indicators of the value-motivational criterion are the most determining, since they characterize the students' conscious attitude and interest in intercultural communication, and provide for the formation of a stable desire of pedagogical students majoring in mathematics for professional activity in a foreign language environment (teaching mathematics abroad, teaching mathematics in a foreign language in the native country, teaching mathematics in the native country to foreign students, etc.).

Indicators of the cognitive-informative criterion characterize the presence of a set of linguistic-methodical, speech-rhetorical and bilingual knowledge, which modern teachers of mathematics must possess for successful intercultural communication.

Indicators of the operational-active criterion indicate assimilation of the necessary knowledge concerning the types and main characteristics of intercultural communication, the peculiarities of conducting mathematics lessons using foreign languages, the mechanisms of «switching» and acculturation, and the norms of speech behavior of a bilingual teacher, etc.

Indicators of the scientific research criterion of foreign language training are especially valuable for future mathematics teachers, who will have to read scientific literature and write articles in a foreign language (usually English). These indicators include analytical-interpretive, text-genre, editorial, and project skills, which are manifested in the ability to think creatively, justify own position, find, select, analyze, interpret information from various sources, as well as to create oral and written scientific texts taking into account the structural-semantic, genre-compositional, linguistic-stylistic features of a foreign language.

Development of the professional-reflective component provides students with the ability to evaluate own strengths and weaknesses for professional activity in the intercultural space, the effectiveness of such activity, as well as to evaluate own and others' experience of the manifestation of intercultural competence in various standard and non-standard professional situations.

Therefore, taking into account the updating processes which occur in the national pedagogical HEIs in accordance with the requirements of globalized society, we conclude that the foreign language training of future mathematics teachers is a complex system that must be implemented in professional pedagogical education institutions in educational, cognitive, developmental and upbringing aspects, and the result of such training is the readiness of mathematics teachers for fulfilment their professional duties in the conditions of globalization. Formation of this readiness is determined by value-motivational, cognitive-informative, operational-active; scientific research and professional-reflective criteria.

## 5. CONCLUSIONS AND PERSPECTIVES FOR FURTHER RESEARCH

Having explored the foreign and domestic scientists' works regarding the essence, content and organization of foreign language training in the system of higher pedagogical education, the authors generalized and systematized the structural-functional model of foreign language training of the pedagogical students majoring in mathematics in the conditions of educational globalization. It was shown that the foreign language training of future mathematics teachers should not be limited only to learning a foreign language. The authors state that it is a significantly wider concept which includes four main aspects of foreign language education: *aspect of education* (presumes learning foreign languages, developing foreign language competence); *aspect of cognition* (presumes learning the distinctive peculiarities of different cultures, awareness of the necessity to carry out cross-cultural communication); *aspect of development* (presumes growth of personal cross-cultural communicative capability, self-education skills, attainment of key linguistic competencies, realization of academic mobility); *aspect of upbringing* (presumes encouraging tolerant attitude to different cultures and nationalities, acquisition of cross-cultural competence). The result of such foreign language training is the teachers' readiness for fulfilment their professional duties in the conditions of educational globalization.

The criteria for the formation of mathematics teachers' readiness for living and fulfilment of professional duties in the conditions of educational globalization are defined as following: *value-motivational criterion* (presumes awareness of the foreign language proficiency value for

professional activity, possession of motivation for cross-cultural communication, striving for personal improvement, personal development and personal realization through the cross-cultural communicative actions and orientation at existence within the foreign language environment); *cognitive-informative criterion* (presumes possession of foreign language proficiency, self-directed education skills, capability to operate information presented in other languages); *operational-active criterion* (presumes ability to use knowing different countries' languages and cultures for solving tasks connected with searching and processing data, as well as carrying out pedagogical assignments of constructive, projective, prognostic, analytical, reflective and diagnostic nature); *scientific research criterion* (presumes the capability to juxtapose foreign and local pedagogical experiences, to establish own innovative practices basing on the best European ideas and examples, to implement the achievements of global scientific research into educational content); *professional-reflective criterion* (presumes ability of foreign experience evaluation, skills of self-assessment and personal cognition, aptitude of foreseeing and overcoming probable complexities which can appear during implementation of foreign innovations into native realities).

As the **perspectives for further research** one can mention investigation the possibility of effective implementation of the best European foreign language training practices in the process of professional training of pedagogical university students majoring in various natural disciplines (Physics, Astronomy, Biology, and Chemistry).

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## РОЗВИТОК ТЕХНОЛОГІЙ ІНШОМОВНОЇ ПІДГОТОВКИ МАЙБУТНІХ УЧИТЕЛІВ МАТЕМАТИКИ В УМОВАХ ОСВІТНЬОЇ ГЛОБАЛІЗАЦІЇ

### Громов Євген Володимирович

доктор педагогічних наук, професор, начальник аналітично-організаційного відділу, професор кафедри педагогіки, професійної освіти та управління освітніми закладами, Вінницький державний педагогічний університет імені Михайла Коцюбинського, м. Вінниця, Україна

ORCID ID: 0000-0002-0234-606X

[yevhen.hromov@vspu.edu.ua](mailto:yevhen.hromov@vspu.edu.ua)

### Коломієць Алла Миколаївна

доктор педагогічних наук, професор, проректор з наукової роботи, професор кафедри педагогіки, професійної освіти та управління освітніми закладами, Вінницький державний педагогічний університет імені Михайла Коцюбинського, м. Вінниця, Україна

ORCID ID: 0000-0003-0536-0147

[alla.kolomiets@vspu.edu.ua](mailto:alla.kolomiets@vspu.edu.ua)

### Гордієнко Юлія Анатоліївна

магістр педагогічних наук, аспірант кафедри педагогіки, професійної освіти та управління освітніми закладами, Вінницький державний педагогічний університет імені Михайла Коцюбинського, м. Вінниця, Україна

ORCID ID: 0000-0003-3084-4434

[yuliiahordiienko1984@gmail.com](mailto:yuliiahordiienko1984@gmail.com)

**Анотація.** Стаття присвячена питанню розробки ефективних технологій іншомовної підготовки майбутніх учителів математики в сучасних умовах глобалізованого освітнього середовища. Автори констатують, що сутність, зміст і структура іншомовної підготовки майбутніх учителів математики суттєво відрізняються від іншомовної підготовки студентів філологічних спеціальностей. Показано, що іншомовну підготовку майбутніх учителів математики не слід зводити лише до традиційного вивчення іноземної мови, оскільки це значно ширший процес, який включає різні сторони іншомовної освіти, такі як: освітня, пізнавальна, розвивальна, виховна. У контексті даного дослідження автори визначають іншомовну підготовку майбутнього вчителя математики в умовах глобалізованого освітнього середовища як визначений масив спеціальних знань, умінь, твердих і м'яких навичок, особистісних якостей і поведінкових норм, які визначають потенційну здатність майбутнього вчителя ефективно виконувати свої професійні обов'язки з