



DOI

10.66073/ReFocus-Conf/
0910228



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1115–1120

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Rajabova Jasmina. The role of English in the development of modern mathematics // «O'zbekiston olimi ayollarining mamlakat taraqqiyotiga qo'shayotgan hissasi» mavzusidagi xalqaro ilmiy-amaliy konferensiya materiallari (Nukus, 2026-yil 9–10-oktyabr). – Nukus, 2026. – B. 1115–1120. – DOI: <https://doi.org/10.66073/ReFocus-Conf/0910228>

THE ROLE OF ENGLISH IN THE DEVELOPMENT OF MODERN MATHEMATICS

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Abstract: This article provides a multifaceted analysis of the role of English in the development of modern mathematics. Since the second half of the 20th century, English has become the language of international scientific communication, serving as a decisive tool for the global dissemination of mathematical discoveries, theories, and practical results. The study shows that factors such as the formation of mathematical terminology, the international scientific publication system, digital resources, and academic mobility are closely related to the English language. At the same time, the national language policy, including the specific features of conducting mathematics education in Uzbekistan in the Uzbek language and the strategic importance of teaching English as a second language, are involved in the analysis. The article is based on theoretical and empirical sources, and practical recommendations are developed on language policy in the field of mathematics education and scientific research.

Keywords: mathematics, English, scholarly communication, lingua franca, mathematical terminology, international publications, academic discourse, educational policy, scholarly collaboration, digital resources.

ENTRANCE

Mathematics has developed as a science with a rich history throughout human history in various civilizations – ancient Egypt, Babylon, Greece, India and the Arab East. Each era and each region has formed its own language of scientific communication and writing traditions: in antiquity, Greek, and in the Middle Ages, Arabic and Latin served as the main means of mathematical texts. Along with the development of science, the means of scientific communication have also changed, and in the new era, especially since the second half of the 20th century, English has become the main means of international scientific cooperation. This process is closely related to global political and economic changes, the scientific potential of the USA and Great Britain, and the revolution in information technologies.

Currently, the world's leading mathematical journals – for example, *Annals of Mathematics*, *Inventiones Mathematicae*, *Journal of the American Mathematical Society*, etc. - are published mainly in English. The same trend is observed in international conferences, scientific grant programs and online resources. This situation requires mathematicians to master the English language unconditionally and is becoming a decisive factor in building an academic career. At the same time, such a global situation creates



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«O'zbekiston olimi ayollarining
mamlakat taraqqiyotiga
qo'shayotgan hissasi»

XALQARO ILMIY-AMALIY
KONFERENSIYA
NUKUS, 9–10-OKTYABR 2026

problems such as limiting the linguistic diversity of national scientific schools and marginalizing scientific literature in minor languages.

The purpose of this article is to analyze the place of the English language in the development of modern mathematics from a historical, linguistic and sociological perspective. The study examines the influence of the English language on the formation of mathematical terminology, the system of international publications, digital resources and its relationship with the Uzbek mathematical school. The objectives of the article are: first, to briefly describe the history of the transformation of the English language into a mathematical lingua franca; second, to show the dominance of the English language in mathematical terminology and nomenclature; third, to reveal the linear relationship between national mathematical education and the English language in the case of Uzbekistan; fourth, to analyze the strengthening of the English-mathematical connection in the conditions of the digital age and artificial intelligence.

Main part

The process of English becoming the dominant language in modern mathematics is the result of several stages of historical development. Until the late 19th and early 20th centuries, mathematical texts were written mainly in French, German, and Latin. The Göttingen Mathematical School, the Paris, and Berlin Academies served as centers of scientific communication during this period. The First and Second World Wars seriously weakened the scientific potential of Europe, causing many prominent mathematicians to emigrate to the United States. The migration of Albert Einstein, John von Neumann, Kurt Gödel, and other prominent scientists to the new continent led to a shift in the center of mathematical research. As a result, by the middle of the 20th century, US universities and research institutes had taken a leading position in mathematics. This process radically accelerated the transformation of English into the language of scientific communication, since new research centers conducted their activities in English.

The influence of the English language is also noticeable in the formation of mathematical terminology. Many terms such as algorithm, matrix, vector, fractal, combinatorics, logic, programming, byte, bit, automaton, graph, isomorphism are used in the global mathematical discourse in their English versions today[11]. Although some terms have Latin and Greek roots, their modern interpretation and scope of application are mainly determined by scientific texts in English. This situation is also reflected in mathematics textbooks in the Uzbek language: many terms are directly adopted from English or are introduced as alternatives to the English version[12]. Such adoptions accelerate the adaptation of mathematical thinking to international standards, but also make the issue of preserving the pure state of the language relevant.

The international scientific publishing system also clearly demonstrates the dominance of the English language. Large publishers such as Elsevier, Springer, Wiley-Blackwell, Taylor and Francis, and the American Mathematical Society publish almost all texts in their journals in English[6]. About ninety percent of the total number of mathematical journals included in the SCI and Scopus databases are

published in English. Indexing in these publications is one of the main criteria that determines the academic career, h-index, and level of talent of mathematicians. Therefore, even French, German, Japanese, or Chinese mathematicians prefer to publish their main discoveries in English. This situation significantly accelerates scientific cooperation and the spread of ideas, but slows down the development of mathematical terminology in national languages.

The advent of the digital age and the widespread use of the Internet have further strengthened the position of English in mathematical communication. Electronic preprint servers such as ArXiv.org serve as open platforms for mathematicians from all over the world, and the majority of texts uploaded there are written in English. Bibliographic databases such as MathSciNet, zbMATH, and EuDML also provide collections of texts mainly in English. On YouTube, Coursera, edX, MIT OpenCourseWare, and other online learning platforms, the majority of mathematics courses are taught in English. These resources allow students and young researchers to acquire knowledge at the level of world standards, but lack of knowledge of English seriously limits the use of these resources. Therefore, teaching English in mathematics education is considered not only a linguistic issue, but also an integral part of the strategy of scientific education.

Since the fields of artificial intelligence and programming are closely related to mathematics, the influence of English is also strong in these areas. Mathematical programming languages such as Python, R, MATLAB, Mathematica are documented in English and their syntax is based on English keywords. The naming of algorithms, machine learning models and the analysis of their values are also expressed in English terms. Terms such as deep learning, neural network, gradient descent, backpropagation have become common to the entire mathematical and engineering community. This situation makes it mandatory to teach programming and English in parallel in mathematics education, otherwise students will be left out of modern scientific and technological processes.

The case of Uzbekistan is also very specific in considering this issue. In the early years of independence, mathematics education was mainly conducted in Russian, since during the former Soviet period the Uzbek mathematical school relied mainly on Russian-language literature and schools. Over the past twenty years, many mathematics textbooks and dictionaries have been published in the Uzbek language, but most of them are still compiled on a comparative basis, in parallel with Russian and English sources. In recent years, the experience of teaching mathematics in English has also begun in higher education institutions: in some universities, including the National University of Uzbekistan, Samarkand State University and Tashkent State Technical University, English has been introduced as a second language in mathematics. This initiative significantly expands the international academic mobility of students and their opportunities for participation in foreign grant programs[10].

However, this process is not without problems. First, the level of English among mathematics teachers is at different levels: many experienced teachers continue to work mainly with Russian-language sources. Second, there are relatively few textbooks and study guides in English, and the high cost of foreign publications

limits their widespread use. Third, the standardization of mathematical terminology in the Uzbek language has not yet been fully completed, and some terms are interpreted differently by different authors. In this situation, teachers are forced to master three languages — Uzbek, Russian and English — together, which can be an additional burden on the mathematics education system. At the same time, multilingualism contributes positively to the development of mathematical thinking and helps students adapt more effectively to the international academic environment.

Furthermore, the widespread use of English raises important questions concerning language policy and the preservation of cultural diversity. Some linguists and sociologists characterize this phenomenon as a form of linguistic imperialism, arguing that the growing influence of English may gradually displace established scientific traditions and practices in other languages. In contrast, other scholars regard the spread of English as a natural and beneficial process that facilitates the standardization of scientific communication. Mathematics, as a universal field of knowledge, can be expressed and developed in any language; however, its contemporary advancement increasingly depends on international collaboration and the use of a shared means of communication. Consequently, the central issue is not whether English should be accepted or rejected, but how it can be effectively balanced with national languages and cultural traditions. Such an approach would allow countries to participate more fully in the global scientific community while simultaneously preserving and strengthening their national scientific traditions and terminology.

In conclusion, the significance of English in contemporary mathematics extends beyond the sphere of language and reflects a broader and more complex process associated with the advancement of scientific civilization, international collaboration among researchers, and the organization of academic knowledge production. For mathematicians, English has become more than simply a tool for communication; it also serves as an important means of accessing scientific careers, research resources, and professional opportunities. Therefore, it remains an urgent task to consider English as a strategic resource in the field of mathematical education and scientific research, to introduce it in a balanced manner within the framework of national language policy. This task is inherent not only to mathematics, but also to other natural and exact sciences, but due to the symbolic and logical nature of mathematics, its connection with English has especially deep and long-term consequences.

Another noteworthy aspect is the influence of English on the assessment of mathematical knowledge. The position of mathematics departments in international ranking indexes, including Quacquarelli Symonds (QS) and Times Higher Education (THE) university rankings, largely depends on the number of publications in English and their citations. Therefore, universities are actively trying to increase their ranking indicators by opening English-language programs and signing international cooperation agreements. In recent years, higher education institutions in Uzbekistan have also joined this trend, organizing joint programs with foreign universities. These programs allow students to receive two degrees and centrally expand mathematical education in English. Thus, English is becoming not only a

language in mathematics education and scientific research, but also a central element of institutional strategy.

Conclusion

The analysis shows that English has been a key factor in the development of modern mathematics. Historically, this process is associated with the weakening of European scientific centers in the mid-20th century and the strengthening of the academic potential of the United States, and today it is strengthened by international publications, digital resources and the field of artificial intelligence. The dominance of English is clearly visible in the formation of mathematical terminology, the system of scientific journals and conferences, and academic mobility.

The trends considered in the case of Uzbekistan show that the widespread introduction of English as a second language in mathematics education can accelerate the integration of students into the international scientific community. However, this process should be carried out in a balanced manner and should not harm the development of the national language and terminology. The recommended measures are: first, to expand the programs for the translation and adaptation of English mathematics textbooks in higher education institutions; second, to organize special courses for improving the skills of teachers; third, to simplify the means of subscription to foreign mathematical journals; fourth, to update and openly present Uzbek mathematical terminological dictionaries online[13].

Future research in this area could focus on exploring the role of AI tools in automatically translating mathematical concepts and facilitating multilingual scholarly communication. This could fundamentally change not only the way the scientific community interacts, but also the future shape of mathematics education.

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