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**PROFESSIONAL TRAINING OF POLISH TEACHERS OF SCIENCE AND
MATHEMATICAL DISCIPLINES IN THE CONTEXT OF EUROPEAN
INTEGRATION**

Abstract: the article analyzes the issue of professional retraining of science and mathematics teachers in the Republic of Poland in the context of European integration processes. The development of the system of retraining and improvement of teachers' qualifications in the Republic of Poland under the influence of socio-political changes that took place in the country starting from the 90s of the XX century is being studied. The analysis of scientific and pedagogical sources regarding the state of retraining and improvement of teachers before the accession of Poland to the European Union was carried out. The regulatory and legal support of the educational process, including international regulations and documents, which became the basis for changes in the training of Polish teachers, was considered. The author described and analyzed modern forms of the organization of retraining of teachers of natural and mathematical subjects in postgraduate education of the country, offered by educational institutions in Poland. The form and content of retraining for teachers of science and mathematical subjects under the postgraduate education programme in the areas of "Pedagogical training" and "Teaching the next subject" were studied.

Key words: teachers of natural and mathematical subjects; professional retraining of teachers; postgraduate education; the Republic of Poland.

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**ПРОФЕСІЙНА ПЕРЕПІДГОТОВКА ПОЛЬСЬКИХ УЧИТЕЛІВ ПРИРОДНИЧО-
МАТЕМАТИЧНИХ ПРЕДМЕТІВ У КОНТЕКСТІ
ЄВРОПЕЙСЬКОЇ ІНТЕГРАЦІЇ**

Анотація: у статті проаналізовано питання професійної перепідготовки вчителів природничо-математичних предметів Республіки Польща в контексті євроінтеграційних процесів. Досліджено розвиток системи перепідготовки і вдосконалення вчителів Республіки Польща під впливом суспільно-політичних змін, які відбувалися в країні, починаючи з 90-х років XX століття.

Проведено аналіз науково-педагогічних джерел щодо стану перепідготовки і вдосконалення вчителів до вступу Польщі в Європейській Союз. Розглянуто нормативно-правове забезпечення освітнього процесу, у тому числі міжнародні положення й документи, які стали основою для змін у питаннях підготовки польських учителів. Описано та проаналізовано сучасні форми організації перепідготовки вчителів природничо-математичних предметів у післядипломній освіті країни, що пропонуються освітніми закладами Польщі. Досліджено форми і зміст перепідготовки для вчителів природничо-математичних предметів за програмою післядипломної освіти в напрямках “Педагогічна підготовка” і “Викладання наступного предмета”.

Ключові слова: учителі природничо-математичних предметів; професійна перепідготовка вчителів; післядипломна освіта; Республіка Польща.

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Розширена анотація для ознайомлення з цією темою:

“Професійна перепідготовка польських учителів природничо-математичних предметів у контексті європейської інтеграції”

Постановка проблеми в загальному вигляді та її зв'язок із важливими науковими чи практичними завданнями. Новітні процеси, започатковані реформою Нова українська школа (2017), спрямовані, насамперед, на створення системи середньої освіти, яка була б спроможна до забезпечення універсального та рівного доступу до якісної освіти. Відповідних змін потребують підготовка вчителів і, зокрема, перепідготовка фахівців математичної і природничої освітніх галузей із метою забезпечення належної якості шкільної природничо-математичної освіти (STEM-освіти). Значення набуває використання ідей конструктивного досвіду професійної перепідготовки вчителів природничо-математичних предметів Республіки Польща, країни, якій у досить короткий термін вдалось інтегрувати свою педагогічну освіту в європейській освітній простір та оновити систему перепідготовки і вдосконалення польських учителів.

Аналіз останніх досліджень і публікацій, у яких започатковано розв'язання цієї проблеми і на які спирається автор. Професійну підготовку і вдосконалення вчителів Республіки Польща досліджували польські науковці Ч. Банаш (Cz. Banach), Є. Вішневська (E. Wisniewska),

З. Воронієцькі (Z. Woroniecki), Д. Дзевановська (D. Dziewanowska), Г. Квятковська (H. Kwiatkowska), Т. Конопка (T. Konopka), А. Котушевіч (A. Kotusiewicz), Е. Меціна-Беднарек (Męcina-Bednarek), В. Прокоп'юк (W. Prokopiuk), Е. Меціна-Беднарек (Męcina-Bednarek), Т. Новацькі (T. Nowacki), Я. Шемпрых (J. Szempruch), Б. Шльіверські (B. Śliwerski).

Розвиток сучасної педагогічної освіти в Польщі проаналізовано українськими науковцями І. Андрущук, А. Штенура. Євроінтеграційним процесам в освіті країн, у тому числі Польщі, присвячені праці дослідниць М. Дернової з питання “Андрогогічна модель професійної підготовки фахівців у закладах вищої освіти країн Європейського Союзу”, Т. Кристопчук щодо проблеми “Тенденції розвитку педагогічної освіти в країнах Європейського Союзу”.

Формулювання цілей статті (постановка завдання). Метою статті є проведення аналізу сучасних досліджень із питань перепідготовки польських вчителів, зокрема фахівців природничо-математичних предметів; визначення форм і змісту перепідготовки вчителів природничо-математичних предметів у післядипломній освіті Республіки Польща.

Виклад основного матеріалу дослідження з повним обґрунтуванням

отриманих наукових результатів. Реформа освіти розпочалася під впливом радикальних змін суспільно-політичного устрою Польщі, досягаючи в послідовних фазах в системній та соціальній трансформації різних стадій розвитку та реалізації. Серед основних причин слабкості системи вдосконалення польських вчителів на період входу Польщі до Євросоюзу в офіційних документах називається неспроможність повною мірою задовольнити потреби підготовлених вчителів через наявні освітні заклади, відсутність злагодженого функціонування окремих елементів системи вдосконалення вчителів в питаннях, що стосувалися встановлення цілей, пріоритетів, використання коштів, методів роботи, аналізу її результатів.

До засадничих передумов освіти вчителів польські науковці відносять: глобальні, європейські та польські цивілізаційні виклики, можливості та загрози великих змін періоду соціокультурних та освітніх трансформацій; довгострокову стратегію вдосконалення та розвитку шкільної й паралельної освіти; модельні засади освіти вчителів і соціальні очікування щодо постульованих функцій і завдань для вчителів, їхніх прав, обов'язків і відповідальності; врахування в системі освіти завдань і діяльності вчителів, ресурсів масової інформації і комунікації з метою формування пізнавальних, мовних, комунікаційних, інтерперсональних, культурних і життєвих компетенцій.

Нині спостерігається інтеграція низки міжнародних правових документів щодо професійного вдосконалення й розвитку фахівців у правове поле країни. До міжнародних документів, які впливають на розвиток системи перепідготовки і вдосконалення вчителів Польщі, що розроблені Європейським Союзом, можна віднести Європейську рамку кваліфікацій

(European Qualifications Framework – EQF, 2008, зі змінами 2017), Рамку кваліфікацій для Європейського простору вищої освіти/ Болонська рамка кваліфікацій (QF для ЕНЕА) (Qualification Framework for European Higher Education Area (QF for ENEA) Bolońskie Ramy Kwalifikacji, 2005).

Перепідготовка вчителів природничо-математичних предметів у післядипломній освіті Республіки Польща спрямована на вдосконалення професійних вмінь, підвищення та розширення кваліфікацій. Навчання має кваліфікаційний характер, що надає можливість отримати кваліфікацію вчителя або кваліфікацію до навчання наступного предмета. До змісту включені питання з методичної, дидактичної, психолого-педагогічної підготовки фахівців. Навчання триває 3 семестри (420/год/515 год відповідно напряму), обов'язковим є проходження практики (150 год). Особливістю підготовки польських вчителів є опанування іноземної мови на рівні B2 за Європейською системою мовного навчання (Europejskiego Systemu Kształcenia Językowego).

Висновки з даного дослідження та перспективи подальших розвідок у даному напрямку. Таким чином, зміни в освітній політиці Польщі в період вступу до Євросоюзу мали позитивний вплив на розвиток педагогічної освіти. До основних завдань освіти були віднесені питання підвищення ефективності системи підготовки і вдосконалення, а також зайнятості вчителів. Нині реформування системи перепідготовки польських учителів, у тому числі фахівців природничо-математичних предметів, характеризується неперервним рухом в напрямі вдосконалення форм, методів і засобів навчання, зміні змісту навчання і програм післядипломної освіти, що спирається на європейські тенденції розвитку педагогічної освіти.

Problem setting. The latest processes initiated by the reform of the New Ukrainian

School (2017) are aimed, first of all, at creating the system of secondary education

that would be capable of ensuring universal and equal access to quality education. The concept of implementation of state policy in the field of the “New Ukrainian School” reform of the general secondary education for the period until 2029 (with changes, 2018)) draws attention to the experience of Eastern European countries (Poland, the Czech Republic) as evidence of the significant impact of educational reforms on the development of the economy and the competitiveness of education at the international level [5]. The training of teachers and, in particular, the retraining of specialists in the fields of mathematics and natural sciences in order to ensure the proper quality of school science and mathematics education (STEM education) requires corresponding changes. Therefore, in the conditions of the creation of a new system of improving the qualifications of teachers of Ukraine, which was announced by the NUS reform, it is important to study and generalize the constructive ideas of the experience of professional retraining of teachers of natural and mathematical subjects in the Republic of Poland, a country that in a fairly short time managed to integrate its pedagogical education into the European educational space and update the system of retraining and improvement of Polish teachers' qualifications

Recent research and publication analysis. The scientific analysis of the chosen problem in pedagogical theory showed that the professional training and improvement of teachers in the Republic of Poland was thoroughly studied by Polish scientists. In particular, the scientists of the Republic of Poland studied such aspects as different approaches to teacher training A. Kotusevich (A. Kotusiewicz), G. Kviatkovska (H. Kwiatkowska)[14], J. Shemprukh (J. Szempruch) [25], strategies for the development of education in Poland Ch. Banakh (Cz. Banach) [8, 9], D. Dzhevanovska (D. Dziewanowska) [11], B. Sliwerski (B. Śliwerski) [26], E. Visnievska (E. Wisniewska) [27], training and professional

development teachers in pedagogical theory and practice W. Prokopiuk [19], Z. Voronetski (Z. Woroniecki) [28], postgraduate education T. Konopka (T. Konopka), E. Mecina-Bednarek (E. Męcina-Bednarek) [13], T. Novacki (T. Nowacki) [17].

The development of modern pedagogical education in Poland was analyzed by Ukrainian scientists, such issues as the management system of professional development of teachers of management departments of universities of the Republic of Poland (I. Androschuk (I. Андрощук) [1]), professional training of future English language teachers by means of distance learning in the universities of the Republic of Poland (A. Shtepura (A. Штепура) [6]) were analyzed. The works of scientists in the following areas as andragogic model of professional training of specialists in the institutions of higher education in the countries of the European Union (M. Dernova (M. Дернова) [2]), the trends in the development of pedagogical education in the countries of the European Union (T. Krystopchuk (T. Кристопчук) [4]) are devoted to the European integration processes in the education of countries, including Poland.

Highlighting previously unsolved parts of the general problem, to which this article is devoted. Analysis of scientific sources shows that the study of retraining of Polish teachers of science and mathematical subjects in postgraduate education of the Republic of Poland has not yet received the sufficient attention and has not become the subject of a holistic analysis. In particular, a comprehensive analysis of the impact of European integration processes on the system of teacher retraining and qualification improvement remains beyond the scope of scientific research.

Paper objective. The purpose of the article is to conduct an analysis of modern research on the retraining of Polish teachers, in particular, specialists of natural and mathematical subjects; define the forms and content of retraining of teachers of natural and mathematical subjects in post-graduate education of the Republic of Poland.

Paper main body. The integration of Ukrainian education into the European educational space acquires a special significance against the background of the decision adopted by the European Council on June 23, 2023, in Brussels, which is historic for Ukraine to grant the status of a candidate for membership in the European Union. This status confirms Ukraine's desire to become a full-fledged member of the European interstate association, and for the European Union it is a way to tell Ukraine about the possibility of joining the European family in the future [7]. The European integration processes taking place in the pedagogical education of Ukraine also require further improvement of the system of postgraduate pedagogical education, in particular in the areas of implementation of continuous education, improving the quality of educational services, ensuring equal access to education, finding new forms, methods and means of education, changing the content and modernization of training and retraining programs, upgrading the qualifications of teachers in postgraduate education in accordance with global trends in education and the requirements of the Ukrainian and international labor markets. "The goal of changes in postgraduate pedagogical education of Ukraine on the way to European integration is to create a model of the educational process in which the best domestic and foreign traditions would be optimally combined" [3].

The transition from a candidate state to a full-fledged member of the European Union was quite successfully carried out by the Republic of Poland, a territorial neighbor of Ukraine and a country with a history and culture close to our country. The changes that have been taken place in Polish society during the last decades really could not help but affect the development of pedagogical education in the country. At the same time, the teaching profession has always exerted a significant influence on the political and educational and cultural life of the country. Therefore, the most significant way to

survive and emphasize the importance of education in the era of changes is the development of the teacher and the school, as pointed out by D. Hopkins, M. Ainskou and M. West [12]. This opinion is confirmed by the Polish researcher J. Szemprukh (J. Szempruch)[25], who notes "the professional development of a teacher and the tasks of the teacher training and improvement system (systemu dokształniania i doskolanania) are influenced, among other things, by demographic processes or changes in the nature of the system's organization and social and political changes taking place in Poland.

The state of professional training of teachers before Poland's entry to the European Union in 2004 is indicated by the results of the research by Polish scientists. Thus, A. Kotusevich (A. Kotusiewicz) and G. Kviatkovska (H. Kwiatkowska)(1985) state that, in the opinion of many teachers, the system of education does not sufficiently "arm" the teacher with the tools for continuous improvement, poorly prepares them for the process of continuous self-education due to the lack of mastery of methods and techniques of independent learning and formation of internal motivation [14]. Analyzing the model of higher education for teachers, J. Szemprukh (J. Szempruch)(2001) notes its impoverishment of elements of pedagogical and psychological education, which are very important. Therefore, it turns out that the end of training and retraining of teachers should be inspired by the new trends and educational concepts and be guided, first of all, by the critical-creative doctrine of education [25]. Z. Woroniecki (Z. Voronetski) (1991) also draws attention to the general opinion regarding the importance of professional training, which specialists acquire in the institutions of higher education – "there is a widespread opinion among teachers, directors, as well as pedagogical supervision workers, that the training obtained in university, most determines the actual professional qualifications of teachers" [28, p.153].

It should be noted that reforming of the Polish education has been taking place in the context of a change in the political system of the Polish state in 1989, which, according to researchers, was the beginning of a long way to a society of dialogue, openness, democracy and pluralism. The reform of education began under the influence of radical changes in the socio-political system of Poland, reaching various stages of development and implementation in successive phases of systemic and social transformation. There was a constant conflict between supporters of autonomy, decentralization, and socialization (*uspołecznienia*) of education and their overt or hidden enemies. New reform projects encountered both resistance from political structures and reluctance, and sometimes even sabotage of the actions of the teachers themselves or trade unionists [26].

A 1994 report of the Department of Teacher Education and Continuing Education of the Ministry of National Education (Departament Kształcenia Nauczycieli i Edukacji Ustawicznej MEN) on the state of improvement of Polish teachers' qualifications can testify to the functioning of the teacher improvement system. The document defined the prospects for desired changes and named two main reasons for the weakness of the teacher training system in Poland, namely: 1) the inability to fully meet the needs of trained teachers through educational institutions; 2) lack of coordinated functioning of individual elements of the teacher improvement system in the matters related to setting goals, priorities, use of funds, work methods, analysis of its results, and mutual support in issuing permits [24].

At the same time, V. Prokopiuk (W. Prokopiuk) (1992) rightly points out that in the existing education system of the Republic of Poland it is impossible to draw a sharp line between professional education (acquiring a profession) (*kształceniem zawodowym*), further improvement (*dalszym doskoleniem*), self-education and individual

and social development. They constitute a general platform for the professionalization and personal development of the teacher, very diverse and enriched with incentives [19].

It should be noted that Polish pedagogical sources contain the term “*dokształcania*”, which has a literal translation of “further education” and means supplementing or expanding education. The concept of improvement (*doskonalenia*) is revealed as improvement, correction, acquisition of greater skills each time in some field. We can talk about continuing education or improvement when the employee decides to participate in any of these forms of postgraduate education independently or when the employer obliges the employee [10]. The functions of additional training and professional development (*dokształcania i doskonalania zawodowego*) of specialists are: 1) adaptation or implementation. Adaptation occurs when an employee is hired for the first job or the working conditions are changing. Implementation occurs when there is a need to reorganize existing experience and skills in accordance with the requirements of the position; 2) stabilization – acts in the replenishment of knowledge and skills to the formal requirements necessary for the position held. This usually involves raising the level of education to the level required by the relevant legal documents; 3) restorative is the result of faster development of science and technology. It consists in updating knowledge some time after graduation; 4) reconstructive – consists in the formation of innovative attitudes and abilities, making creative efforts aimed at implementing innovative solutions in the work; 5) requalification – should lead to a change in professional specialty or obtaining an additional specialty [17].

The famous Polish scientist Ch. Banach (Cz. Banach), (1997) notes that a significant number of reforms are taking place in the field of pedagogical education. In general, they were associated with the reform of school education, which required a

new approach to education taking into account important factors of its development [9]. The researcher attributes global, European and Polish civilization challenges, opportunities and threats of major changes in the period of socio-cultural and educational changes to the basic prerequisites of teacher education; long-term strategy of transformation and development of school and parallel education; model principles of teacher education and social expectations regarding postulated functions and tasks for teachers, their rights, duties and responsibilities; taking into account in the education system the tasks and activities of teachers, as well as the competition of available mass information and communication resources with the aim of forming cognitive, language, communication, interpersonal, cultural and life competencies [9]. According to Ch. Banach (Cz. Banach), (1998), the education of modern teachers should be a multilateral, multifunctional and interdisciplinary process that takes place in three time dimensions: past, present and future, and in four spaces: regional, Polish, European and global, as well as in three spheres: axiological-cognitive, emotional and practical [8, p. 15].

Modernization reforms were related to the constant updating of the content of education, school textbooks, equipping schools with teaching aids, development of modern methods of pedagogical influence and teacher training. This type of reform was associated with the use of the modern model of education, which was not previously available in Poland, and with the "adjustment" of the domestic content of education to mandatory decisions in the countries of the European Union, such as the study of foreign languages or the introduction of the state final exam (examin maturalny) [27].

In the strategy for the development of education in Poland for 2007-2013 (Strategia rozwoju edukacji w Polsce na lata 2007-2013) it was stated that in the reformed education system the most important are the

pupil, student, participant of continuous education, to whom the strategy directs its action, as well as the teacher, responsible for the development of the activity participant. The legislation, which entered into force on October 1, 2004, paid attention to the requirements and duties of the 21st century teacher, made changes to the standards of teacher training, disciplines for teacher training, the scope of practice, as well as the content of programs and mandatory skills (knowledge of a foreign language at an advanced level and use of information technologies). An important change was also the requirement in the preparation of teachers to study two subjects and to have a higher education in two subjects. The main goal of the development of education in Poland defined by the document was to increase the education of the population, while ensuring the high quality of education. Emphasis is placed on the importance of constantly improving the level of qualifications of adults, primarily professional qualifications, and general competencies necessary for functioning in modern society [21].

Therefore, the changes taking place in Polish education demanded that the institutions (instytucji) engaged in training for the teaching profession create a new quality of education, since, as D. Dzhevanovska (D. Dziewanowska), 2002) notes, this profession requires a variety of skills and a wide range of professional competencies that will allow the teacher to work effectively in the changing school reality, which requires bringing the standards and quality of education to the needs of Europe, that is uniting [11].

It is important to note that international regulations and documents became the basis for changes in the issues of regulatory and legal provision of training and retraining of Polish teachers. Currently, the integration of a number of international legal documents regarding the professional improvement and development of specialists into the legal field of the country is observed. Among the international documents t

developed by the European Union, that affect the development of pedagogical education in Poland and relate to the organization of continuous education of specialists and lifelong learning, we can include such documents as the White Book "Teaching and Learning" (1995), the Lisbon strategy of lifelong learning (2000), Recommendations of the European Parliament and the European Council "On core competences in the process of lifelong learning" (2006), Recommendations of the European Parliament and the European Council "On the creation of a European qualification framework for lifelong learning" (2008), "Lifelong Education" Programme of actions for 2007-2013 (2006), Recommendations of the European Parliament and the European Council "On the creation of a European Qualifications Framework for Lifelong Learning" (2009), Strategy for Smart and Sustainable Development – Europe 2020 (2010), European Qualifications Framework (European Qualifications Framework – EQF, 2008, revised 2017), Qualification Framework for European Higher Education Area (QF for EHEA) (Bolońskie Ramy Kwalifikacji, 2005). They have a recommended nature, but at the same time they are fundamental international documents in the sphere of Polish state policy on pedagogical education and professional development of teachers.

With the support of the common European system, the current educational standards of training for the teaching profession have been developed, which allows comparing diplomas obtained in different universities in Europe [11]. The Decree of September 23, 2003 on teacher training standards of the Ministry of National Education and Sport (Rozporządzenie Ministra Edukacji Narodowej i Sportu z dnia 23.09.2003 w sprawie standardów kształcenia nauczycieli) [29] clearly defines the competencies that a teacher must demonstrate upon completion of higher or postgraduate education; these are didactic, educational and social, creative,

praxeological and communication and informational and media competences. Other important documents on teacher training are the regulations of the Ministry of National and Higher Education (Ministerstwa Edukacji Narodowej i Szkolnictwa Wyższego) regarding the national framework of qualifications for Polish higher education, that is the Decree of January 17, 2012 on the educational standards of training for the teaching profession (Rozporządzenie z dnia 17 stycznia 2012 r. w sprawie standardów kształcenia przygotowującego do wykonywania zawodu nauczyciela) [30].

Training to prepare for the profession of a teacher is carried out through the acquisition of education:

1) according to the direction, level and profile, the programme for which determines the learning outcomes, that is specified in the Law of December 22, 2015 "On the Integrated Qualification System" (ustawie z dnia 22 grudnia 2015 r. o Zintegrowanym Systemie Kwalifikacji) [21], taking into account the universal characteristics of the first degree defined by that Law, and also the second degree characteristics of the Polish framework of qualifications specified in the provisions issued by the Law on the basis of Art. 7 p. 3 of that Law and learning outcomes defined in the Standard.

2) postgraduate, the programme for which determines the learning outcomes for partial qualifications taking into account the second level characteristics of the Polish Qualifications Framework at level 6, 7 or 8 of the Polish Qualifications Framework specified in the resolutions issued on the basis of Art. 7 p. 3 and 4 of the Law of December 22, 2015 on the integrated system of qualifications and learning outcomes defined by the Standard [13].

Public and private institutions of higher education provide postgraduate education of specialists. For example, postgraduate education for teachers organized by the Higher School of Professional Education in Vroslav (Wyższa

Szkoła Kształcenia Zawodowego, Wrocław) provides training in 15 areas (293 specialties).

Among the areas of study offered by this educational institution are pedagogy, areas in the field of pedagogical training, areas in the field of special pedagogy, areas in special pedagogy for special teachers, areas in the field of speech therapy, early learning of foreign languages, areas in the field of therapy, directions in the field of education, sensory integration, the other in pedagogy, subject-based learning, psychology, etc. Education in natural and mathematical disciplines combines the following subjects as biology and nature, biology and geography, chemistry and nature, geography and nature, geography and chemistry, geography and physics, biology and chemistry, mathematics and physics, mathematics and biology, mathematics and chemistry, mathematics and geography [33].

Postgraduate education in the direction of “Teaching the next subject” has a qualifying nature. For example, the postgraduate course “Teaching Mathematics and Geography” (Nauczanie matematyki i geografii) is organized by the Higher School of Vocational Education in Wrocław (Wyższa Szkoła Kształcenia Zawodowego, Wrocław) [16]. Students are qualified to teach mathematics and geography in all types of schools (primary school, gymnasium, technical school and vocational school). The duration is 3 semesters (including 180 hours of practice). Training is carried out using training methods of online learning (e-learning). Education consisting of two parallel courses, i.e. mathematics education and geography education, is envisaged (Table 1). Education is qualification-based and enables teachers to acquire qualifications for teaching a second subject. Upon completion of the

above postgraduate course, the graduate receives two certificates, i.e. separate documents for each of the subjects to be taught (in accordance with the instructions of the Ministry of Science and Higher Education). The legal basis of education for the implementation of the course is the Resolution of the Minister of National Education of August 1, 2017 concerning the special qualifications that are required from teachers (Rozporządzenie Ministra Edukacji Narodowej z dnia 1 sierpnia 2017 roku w sprawie szczegółowych kwalifikacji wymaganych od nauczycieli) [31] and the Decree of the Minister of Science and Higher Education of July 25, 2019 on the Standard of education for preparation for the teaching profession. (Rozporządzenie Ministra Nauki i Szkolnictwa Wyższego z dnia 25 lipca 2019 r. w sprawie standardu kształcenia przygotowującego do wykonywania zawodu nauczyciela, Dz. U. z 2019 r. poz. 1450) [32].

The training programme is aimed at providing teachers with subject knowledge, including education in the amount necessary to implement the content of education contained in the basic curriculum of general education in the scope of a given subject (type of classes) and educational stage or educational stages or in the basic curriculum of vocational and technical education; knowledge of training in the field of subject didactics (teaching methods) of a specific subject at this educational stage; practical knowledge obtained during practice, the purpose of which is to accumulate experience related to the educational and educational work of the teacher, and to compare the acquired knowledge in the field of didactics (teaching methods) of the subject (type of classes) with pedagogical reality in practical action.

Table 1

Subjects taught at different stages of education

Subject name	Educational stage I (grades 1-3 of primary school)	Educational stage II (IV-VIII grades of primary school)	Branch school of the 1st degree	Lyceum / Technical school
Mathematics	*	y	y	y
Geography		y	y	y

*Integrated learning

Source: [16]

The system of training and improvement of teachers' qualifications in postgraduate education in Poland today is mobile and flexible, able to meet the various needs of specialists regarding the assignment of appropriate qualifications. Qualification training, which is carried out as part of preparation for teaching the next subject, can be implemented to acquire a qualification in a separate subject. Thus, training under the program of postgraduate education in the field of "Mathematics" is organized on the basis of the Institute for the Development of Education in the city of Katowice (Instytut Rozwoju Edukacji, Katowice). The training is addressed primarily to teachers who want to obtain professional qualifications for teaching mathematics in the schools of all types. The term of study is 3 semesters (420 hours); the form of study is online. The purpose of education is to provide modern knowledge in the field of mathematics, expand and supplement professional skills related to learning this subject. Education consists of theoretical and practical training. The program in this field of postgraduate education involves the study of such disciplines as the basics of didactics, voice emission, the ethics of the teaching profession, information technologies in education, elementary geometry, the basics of mathematical analysis, didactics of teaching mathematics (IV-VIII grades), didactics of mathematics (secondary school), didactics of teaching mathematics to children with dyscalculia, elements of mathematical logic, analytical geometry, arithmetic and algebra, probability calculus with statistics [15].

For Polish specialists, a teacher's acquisition of qualifications and mastery of professional competence is a necessary condition for the effective performance of school tasks and functions. The teacher must have a full academic education and be able to teach innovatively using new technologies [11]. For specialists who do not have a pedagogical education, training is offered at courses organized in various types of institutions, namely institutions of higher

education, special professional development institutions (teacher development institutions), teacher centers and schools.

In particular, the course for teachers according to postgraduate education programmes in the specialty "Pedagogical training" (Przygotowanie Pedagogiczne) is offered by the Institute for the Development of Education (Instytut Rozwoju Edukacji) in Katowice [20]. The study period is 3 semesters, 515 hours, of which 150 hours are practical (75 hours in a primary school and 75 hours in a secondary school). The form of education is online learning. The training is addressed to applicants who already have a diploma of higher education (vocational and technical, bachelor's or master's), but do not have a teaching qualification; after graduation they can work as a teacher in all types of schools and institutions (except for primary and special education). It is assumed that the graduate of the course will be prepared for the comprehensive implementation of educational, educational and health-improving tasks of the school, therefore, he must understand the field of selected pedagogical specialties in such a way as to competently transfer the acquired knowledge and independently deepen and update it, as well as integrate it with other fields of knowledge; must be aware of psychology and pedagogy in order to perform educational and guardian functions, support the comprehensive development of students, individualize the learning process, meet the special educational needs of students, organize social life at the level of the class, school and local environment, cooperate with other teachers, parents and the local community; must understand subject didactics with the aim of effective conducting of educational classes, stimulating cognitive interests and promoting the mental development of students through the skillful selection of activating methods, techniques and means of learning, as well as checking and evaluating the achievements of students; must have a command of information technologies, including their use in teaching the subject [20].

The program in this direction involves the study of the following areas as psychology of learning of children's education, basics of didactics, psychology of development and personality, basics of pedagogical diagnostics, formal and legal basics of school/institution functioning, emission of voice, ethics of the teaching profession, information technologies in education, basics of special pedagogy, social pedagogy, the Law on Education, general psychology, general pedagogy, school as an educational institution, basic curriculum for preschool and general education, basic curriculum of vocational education, teaching methods of general education subjects, teaching methods of vocational subjects, diagnosis, control and evaluation of learning results, cultural foundations of education, prevention at school, personal and professional development of the teacher, training of effective communication and self-confidence, training of social skills, training of parenting skills, principles of occupational safety in educational institutions, first aid in educational institutions, the method of a good start, practice [20].

In Poland, postgraduate education institutions independently establish the forms of the educational process (stationary, remote) and the types of educational activities (lectures, practicals, master classes, trainings, conferences). Thus, the form of organization of the educational process in the postgraduate education programmes at the University of Lower Silesia in Wroclaw (Uniwersytet Dolnośląski DSW Wroclaw) is hybrid, which is also called mixed. Classes are held partly online, partly in classrooms, since not all the content, and above all skills, can be transferred through online learning; some workshops and meetings lose their educational value when they are held online [22]. Organization of studies under the postgraduate education programme at the Higher School named after Bohdan Janskyi, a branch in Krakow (Szkoła Wyższa im. Bogdana Jańskiego. Filia w Krakowie) is aimed at meeting the needs of education

seekers as much as possible. The training lasts two, three or four semesters; the time of classes is adapted to the possibilities of the teachers who are already working. Classes are held on Friday afternoons and Saturdays, Sunday is always free [23].

Therefore, the conducted analysis of pedagogical sources proved that the retraining of teachers of natural and mathematical subjects in postgraduate education of the Republic of Poland is aimed at improving professional skills, increasing / expanding qualifications. Postgraduate education programmes are qualification-based and enable specialists to obtain a teacher's qualification or a qualification with the right to teach the next subject. The content includes questions on methodical, didactic, psychological and pedagogical training of specialists. Education lasts 3 semesters (420 h / 515 h according to the field of study), and necessarily includes practice (150 h). A special feature of the training of Polish teachers is their acquisition of knowledge of a foreign language at the B2 level according to the European System of Language Education (Europejskiego Systemu Kształcenia Językowego).

Conclusions of the research. Thus, changes in the educational policy of Poland during the period of accession to the European Union had a positive impact, in particular, on the development of pedagogical education. The main tasks of education included issues of increasing the effectiveness of the training and improvement system, as well as the employment of teachers. Currently, the reform of the system of retraining of Polish teachers, including specialists in natural and mathematical subjects, is characterized by a continuous movement in the direction of improving the forms, methods and means of education, changing the content of education and programs of postgraduate education, which is based on European trends in the development of pedagogical education. Accordingly, a series of changes regarding the methodology of conducting classes, the

organization of the educational space for retraining teachers, which is connected with the use of information technologies in modern education, continues.

We see the prospects for further exploration in the study of the problem of teacher retraining with the aim of enabling access to the international labour market,

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Стаття надійшла до редколегії 08.09.2023