

The genesis of the professional technical education system in Poland in the 16th–19th centuries within the general context of European socio-economic changes

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Abstract.

The study purpose is to analyze formation and development of the professional technical education system in Poland during the 16th–19th centuries in the general context of socio-economic changes taking place in Europe at that time. **The research methodology** is based on combination of heuristic approach and historical reconstruction of the events under study. A historical-systemic analysis of the organization of professional technical education in Poland was applied based on a retrospective study of the main educational trends of that time in the context of key socio-political events. **The scientific novelty** lies in the implementation of integrated comparative analysis of the almost four-hundred-year (16th–19th centuries) evolution of the Polish system of professional training of specialists in technical specialties in the context of pan-European educational trends. The study highlights the provisions on general trends in the organization of professional education in contemporary Poland, as well as its ability to function effectively and accumulate human capital in the conditions of changing economy. **Conclusions.** Historical and pedagogical analysis of the development of the professional technical education system in Poland during the 16th–19th centuries in the general context of European socio-economic changes allowed the authors to identify its institutional and structural changes, assess the factors of efficiency and compliance with contemporary approaches to the organization of professional training. The authors prove that professional technical education in Poland as a social institution developed historically due to the significant influence of socio-economic reasons and material production and evolved in accordance with changes in organization of social life at different stages of the country's historical development. The most important period in the overall evolution of Polish education was the second half of the 18th century, but the first quarter of the 19th century was crucial for the development of professional technical education, when the separation of educational institutions with a polytechnic or special vocational orientation began. The most difficult times for Polish professional education undoubtedly came after the defeat of the uprisings of 1830–1831 and 1863–1864.

Keywords: historical and pedagogical analysis, Poland, industrial development, vocational education, professional technical education.

Гене́за системи професійної технічної освіти Польщі в 16–19 століттях у загальному контексті європейських суспільно-економічних змін

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Анотація.

Мета дослідження – проаналізувати становлення та розвиток системи професійної технічної освіти Польщі впродовж 16–19 століть у загальному контексті соціально-економічних змін, що відбувалися у тогочасній Європі. **Методологія дослідження** ґрунтується на поєднанні евристичного підходу й історичної реконструкції подій, що вивчаються. Застосовано історико-системний аналіз організації професійної технічної освіти Польщі на основі ретроспективного дослідження основних тогочасних освітянських тенденцій в контексті ключових подій суспільно-політичного характеру. **Наукова новизна** полягає у здійсненні інтегрованого порівняльного аналізу майже чотирьохсотлітньої (16–19 століття) еволюції польської системи професійної підготовки фахівців з технічних спеціальностей у контексті загальноєвропейських освітніх тенденцій. Дослідження висвітлює положення щодо загальних тенденцій в організації професійної освіти тогочасної Польщі, а також її здатність ефективно функціонувати та накопичувати людський капітал в умовах економіки, що змінюється. **Висновки.** Історико-педагогічний аналіз розвитку системи професійної технічної освіти Польщі впродовж 16–19 століть у загальному контексті європейських соціально-економічних змін дозволив виявити її інституційні та структурні зміни, оцінити чинники ефективності та відповідність тогочасним підходам до організації професійного навчання. Авторами доведено, що професійна технічна освіта Польщі як соціальний інститут склалася історично завдяки визначному впливу соціально-економічних причин і матеріального виробництва та еволюціонувала відповідно до змін організації всієї суспільної життєдіяльності на різних етапах історичного розвитку країни. Найбільш важливим періодом у загальній еволюції польської освіти була друга половина 18 століття, проте для становлення саме професійної технічної освіти доленосною стала перша чверть 19 століття, коли почалося виокремлення навчальних закладів, що мали політехнічну або спеціальну професійну спрямованість. Найважчі часи польська професійна освіта переживала після поразки повстань 1830–1831 та 1863–1864 років.

Ключові слова: історико-педагогічний аналіз, Польща, промисловий розвиток, професійна технічна освіта.

The Problem Statement. Socio-economic transformations in Europe inevitably led to significant restructuring of various sectors of the economy, the disappearance of certain areas of production and emergence of others. At the same time, industrial enterprises still remain system-forming elements of the most important spheres of life of every developed country. The level of the production forces training largely determines long-term economic development, acts as a catalyst for

the introduction of new technologies, and ensures sustainable economic growth. The issue of the effective functioning of the system of training specialists in technical specialties traditionally gains particular importance due to their greater focus on practical activities and the need for close interaction with industry, which is constantly undergoing significant changes. In this context, one can observe notable achievements of Eastern European countries, which successfully compete in the European and global markets, determining the main directions of socio-economic relations development, including trends in professional training of specialists. Objectively, Ukraine is not yet among the leading countries in this field, however, it is making considerable efforts in updating the professional education content and improving its methodology in accordance with social and technological transformations. Solving a set of complex educational tasks requires a comprehensive study of the dynamic changes in the education systems of neighboring countries with social, historical, political and socio-economic processes similar to Ukraine. The Republic of Poland is one of them. The country became a member of the European Union due to a deep reform of not only the socio-economic systems, but also the system of professional training. In particular, Poland intensified contacts with the Western Europe states in the field of professional education. As a result, the influence of the educational policy of these countries on the Polish system of professional training has significantly increased. Ukraine is heading the same direction, so the Polish positive changes may be a good example for resolving issues of organizing the content, forms and technologies of professional education.

Analysis of Sources and Recent Research. The source base of the research includes the legislative acts of the First Polish-Lithuanian Commonwealth and archival documents of the partitioned Poland's parts which were annexed by the Prussian, Austro-Hungarian and Russian empires.

Over the years, substantial historical and pedagogical research into the Polish system of professional training has been carried out by both Polish and Ukrainian scholars. It is quite natural that the most relevant materials are contained in the works by Polish researchers: vocational education (Bereznicki, 1990; Krystkowiak, 2006; Kurek & Rachwał, 2012; Lis et al., 2017; Nowak, 2017; Ornatowski & Figurski, 2000; Szlosek, 2008; Woźniak, 2000; Zych, 2006); professional training in the process of social change (Baraniak, 1998; Bochenek, 2012; Bogaj, 1998; Hetnal, 1990; Jeruszka, 2000; Kabaj, 1998; Kwiatkowski, 2001); integrative processes in professional training (Gerlach, 2002; Kwiatkowski, 2002; Trafiałek, 2008; Wiatrowski, 2003); theory and methodology of professional training (Figurski & Symela, 2001; Gniazdowska, 2001; Pulturzycki, 1997); history of professional training in Poland (Baranowska & Fiktus, 2019; Czajkowska, 2015; Dziwulski, 1996; Franaszek, 2002; Gulczyńska, 2023; Hickiewicz, 2023; Leśniak, 2023; Lis, 2017; Nowicki, 2018); training of engineering and technical personnel (Antonowicz, 2020; Czerwińska, 2004; Debska, 2006; Jasiuk, 2006; Hickiewicz, 2025; Kaczynski, 2011; Kups, 2014).

In Ukraine, comparative historical and pedagogical research on the peculiarities of professional education in Poland was carried out in such aspects as: history of Polish pedagogical science (Nyczkało & Szlosek, 2008); evolution of vocational and technical schooling in Poland (Lukianova & Symela, 2024; Pavlenko, 2025); the role of Ukrainians in development of Polish universities (Gorenko et al., 2022; Wolaniuk, 2010); establishment and development of higher education of Poland (Rusina, 2016); innovations in Polish education (Andrushkevych, 2011); reformation of Polish professional training system (Danilova, 2014; Sisoeva & Kristopchuk, 2012; Vasyliuk A., 1999); development of the Polish system of continuing education (Desiatov, 2005).

At the same time, our analysis of the works by Polish and Ukrainian scholars shows that the issues of the formation and development of the Polish system of training specialists in technical specialties in the general context of European socio-economic changes remain not covered in certain aspects.

The Purpose of the Article – to analyze formation and development of the Polish professional technical education system during the 16th-19th centuries in the general context of socio-economic changes taking place in Europe at that time.

Presentation of the main material. The organized professional education in Poland as a social institution, as a subsystem of society, has developed historically. There are different opinions about the reasons for its emergence. Some proceed from the determining role of socio-economic reasons and material production, others derive the professional education system from the practice of state formation, clergy, and public administration. Considering this, it can be assumed that the professional education system developed as a result of changes in the organization of all social life (Hryshchuk, 2016, p.102).

In the Middle Ages, European education was mostly characterized by extreme conservatism and dogmatism, boundless faith and worship of church authorities. The predominant importance of the upbringing function in the general structure of education system remained until the emergence of capitalist relations. Due to the commercialization of medieval society, cities turned into centers of intellectual development. The educational model also changed: the importance of the upbringing

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function in the education system gradually lost its dominant position in comparison with the cognitive function. The tutor in faith (*praеceptor*) was replaced by the master (magister, doctor) – an intellectual leader who taught methods of professional thinking. Unlike the tutor in faith, the master was already a specialist (*specialis*), that is, an expert not on the whole, but only on a part – a narrow specific sphere.

An important milestone in the development of European education system is the emergence of universities in the 11th-14th centuries (Bologna – circa 1088; Oxford – circa 1200; Paris – circa 1200; Cambridge – 1209; Salamanca – 1218; Padua – 1222; Prague – 1349; Krakow – 1364; Vienna – 1365), which became centers of intellectual life in Europe (Croix, & Vitale, 2022, p. 2). Universities, as well as pragmatically oriented guild and workshop schools, provided the conditions for the reform of the scholastic education system. From the point of structural organization, the first universities resembled the craft guilds: educational process was regulated by statutes similar to those that regulated craft production (the main governing body was a general meeting under the leadership of an elected chairman, with clearly regulated discipline, quality of teaching, and structure of subordination among guild members). The graduations of students, bachelors, masters or doctors in universities corresponded to the guild graduations of apprentices, journeymen and masters. The highest level in the structure of universities (educational guilds) was made up of doctors (masters) – full members of a certain professional union (corporation), whose professional level was determined by the accepted standard. It was the strict regulation and standardization of the university activities that ensured a high level of quality and reliability of medieval science as a way of thinking, which later on became the foundation for modern science, which in turn is the basis of technocratic civilization (Rüegg, 1992, p. 128).

In the 16th–18th centuries, geographical discoveries and significant achievements in other branches of natural science radically changed the worldview. Under their influence, the awareness of the need to update the goals and methods of education came. A significant number of specialized educational institutions were founded – technical, industrial, commercial, military, and navigation schools. The higher level of the education system was expanding at the expense of natural science and technical faculties. The disdain for natural sciences, which was characteristic of the aristocracy and clergy, was replaced by an orientation towards the acquisition of knowledge and skills necessary for commercial success. The most noticeable change was in the system of vocational education, which was brought into being by the need to meet new requirements for the mass training of a new type of worker for capitalist production.

In the second half of the 18th century, coal and iron ore were actively mined to power steam engines and smelt metals. Industry contributed to the development of science; science, in turn, determined the pace of industrial development. While ancient scientists studied natural phenomena mainly to satisfy own curiosity, the 18th century science was gradually turning into a profession (Dziewulski, 1996, p. 33). An important factor in the expansion of professional education was the formation of an interested social group that claimed its share in social wealth. In industrially developed countries people began to influence the government, so wider access to professional education became possible. Radical changes were also taking place in teaching methods. This was manifested in the rejection of scholastic methods that had prevailed for centuries and the adoption of new didactic and educational approaches developed by humanist thinkers J.-A. Comenius, J.-J. Rousseau, J.-G. Pestalozzi (Cerna, 2021, p. 348).

The 19th century in Europe was the era of steam and electricity: steam engines, coke in metallurgy, steel rolling, the beginning of mass production – all this led to the need for theoretical and scientific knowledge that explained the production process itself. Theoretical training of specialists along with an integral internship with masters became mandatory. Over time, traditional humanitarian education and the emerging professional education embodied two antagonistic ideas. Fierce disputes were waged between the supporters of these concepts: representatives of the humanitarian direction accused their opponents of limited utilitarianism, which is unworthy of human; supporters of professional education, in turn, defined humanitarian education as life-barren, accessible only to privileged classes (Dziewulski, 1997b, p. 30).

In the 16th–18th centuries, the Jesuit Order, founded in 1540 under the auspices of Pope Paul III, played an important educational function in Europe. The network of representative offices of the Order grew rapidly both in Europe and around the world. The Order's members attached great importance to working with the young, founding new affiliated schools, which at that time were considered educational institutions of a fairly high level. The Jesuits also played an important role in Poland. During the time of Cardinal Stanisław Hozjusz, in 1564, the first theological seminary in the country was opened in Braniewo. The further expansion of the Order was quite quick – the Jesuits organized their schools in all the centers of political and cultural life. In total, more than 60 Jesuit colleges were opened on the territory of the Kingdom of Poland. The central one was the Vilnius Academy, which formed the basis of higher and secondary education in Poland in the 17th–18th

centuries. The Order included prominent Polish scholars who made significant contribution to the development of various fields of knowledge (Paluszkiewicz, 1995, p. 175).

Since the middle of the 17th century the University of Krakow (*Uniwersytet Krakowski*) actually plunged into scholasticism. The first step towards renewal was the initiative of the royal secretary, architect-fortifier K. Mieroszewski to establish an Academy of Exact Sciences (*Akademia Marsowa*) at the university. The Sejm (Polish Parliament) of 1676–1677 approved this idea, but the practical implementation failed. Only in the second half of the 18th century the programs of exact and natural sciences were restored. They included mathematics, physics, mechanics, optics, astronomy, hydrography, and geography (Dziewulski, 1997a, p. 43).

In the 1740s, the prominent public figure and educator Stanisław Konarski initiated the first educational reform in Poland. Among the main directions of the reform there were: the use of Polish (instead of Latin) as the language of instruction; updating the curricula; introducing physical and labor education; intensified study of logic, rhetoric, ethics, physics, mathematics, astronomy, botany, global and national history, geography. The reforms by Stanisław Konarski forced representatives of Jesuit schooling to introduce innovative changes in the curricula and teaching methods. Study of French and German (in addition to Latin) and rejection of cramming were the most noticeable. In addition, in some Jesuit colleges (in Vilnius, Warsaw, Poznan) courses of practical sciences were introduced. The departments physics and mechanics were established as well (Kostkiewicz, 2004, p. 137).

In 1740, as part of the reforms, the Collegium Nobilium was founded in Warsaw. It was an eight-year educational institution with the most modern and comprehensive curriculum at that time, in which the study of Greek and Latin was limited, instead, more attention was paid to natural sciences and mathematics, «live» foreign languages and philosophy. The basics of economic theory and law was also taught there. This was a significant breakthrough compared to the curricula of Knights and Jesuit schools of the time (Kostkiewicz, 2004, p. 164).

In the second half of the 18th century, even being surrounded by absolutist states, the Polish-Lithuanian Commonwealth enjoyed certain freedoms. During the reign of the last elected Polish king Stanisław August Poniatowski (1764–1795), a series of reforms strengthened the country's economic development: manufactures were built, mining developed, agriculture improved, but, most importantly, there appeared a new generation of citizens who were aware of their goals and responsibilities. It was on Poniatowski's initiative that in 1765 the Knight's School (*Szkola Rycerska*) was founded in Warsaw. It was a six-year secular school, fully maintained at state expense, which made it possible to educate 200 cadets annually. The school was, to a certain extent, the mixture of the Prussian knightly schools (*Ritter-Schule*), which flourished during the reign of Frederick II, and the French state administrative schools (*Ecole Nationale d'Administration*). The school was attended mainly by representatives of impoverished provincial gentry youth, who were trained for both military service and civil or public activities. The curriculum, along with purely professional military disciplines, also included courses in mathematics, mechanics, economics, history, geography, law, foreign languages, and construction (Czartoryski, 1916, p. 6–7). The Knights' School existed until December 1794 when it was closed after the defeat of the uprising led by Tadeusz Kościuszko.

After the First Partition of Poland, some reforms in the field of public education were introduced. The reforms were primarily associated with the establishment (in 1773) of the Commission for National Education (*Komisja Edukacji Narodowej*), the first central educational governing body in the territory of the Polish-Lithuanian Principality. Given its broad powers and autonomy, the Commission can be considered the first Ministry of Education not only in Poland but also in Europe at large, and an important achievement of Polish education. The main reason for the Commission emergence was the excessive conservatism of Jesuit schools, which negatively affected the quality of education compared to other European states. In addition, in 1773 Pope Clement XIV completely liquidated the Jesuit Order. This decision could have led to the complete decline of education in the Polish-Lithuanian Principality, since the Order was in charge of the vast majority of educational institutions throughout the country. Poland needed to create an effective administrative body that would take care of public education issues (Dziewulski, 1997a, p. 44). The Commission included influential Polish political figures, writers and scientists of that era, and the most prominent figure and main founder was Hugo Kołłątaj – the priest, politician, educator and publicist. Although the Commission initially faced strong resistance from conservative forces in the Sejm, being supported by the king and the leading political party *Familia*, it gained almost complete independence. In 1773, all Jesuit property, including schools, palaces, farms and villages belonging to the church, was transferred to the Commission, thanks to which it received not only the necessary infrastructure, but also a profitable income sources. Since 1774, the Library of Załuż has been subordinated to the Commission. Later on, Kołłątaj proposed a three-level structure of education, which included: parish schools for peasants and burghers; county schools for children of nobles (although children from lower social classes could be admitted); higher educational institutions – universities (academies) (Pasztor, 1991, p. 133).

As teaching in the Polish-Lithuanian Principality was mainly conducted in Latin, the Commission faced the problem of an almost complete lack of Polish-language educational literature. In order to overcome the problem, the Elementary Books Society (*Towarzystwo Ksiąg Elementarnych*) was founded. The Society members had to work not only on the elaboration of new Polish-language textbooks and manuals, but also to develop a Polish specialized terminology vocabulary. A large number of chemical, physical and mathematical terms that were developed at that time are still used by Polish scientists today (Pasztor, 1991, p. 142).

In addition, the Commission developed a number of documents that regulated the general educational process. However, some of the new ideas were considered too revolutionary and were therefore not followed (for example, the provisions on equality of men and women in obtaining education). Starting in 1781, the Commission for National Education began to develop a new educational model. The universities in Kraków, Warsaw and Vilnius were given the right to supervise lower-level educational institutions. This category of included, among others, schools that were still under the Catholic Church patronage. The teachers, who were former Jesuit priests, were gradually replaced by young secular teachers, graduates of the aforementioned universities. Thanks to this reform, the opposition within the local schools was gradually overcome (Lis, 2017, p. 766).

Taking as a model the Institute of Sciences, which was established in 1711 at the University of Bologna, Kołłątaj initiated establishment of the new organizational structures at existing educational institutions, the so-called «main schools», which paid sufficient attention to the teaching of technical, natural and medical sciences. Thus, at the end of the 18th century the Main Crown School (*Szkoła Główna Koronna*) was established at the Krakow Academy, which included an astronomical observatory, a medical clinic, and a physical laboratory (Morawski, 1900, p. 254). Later on, in Vilnius and Warsaw, the Main Lithuanian School (*Szkoła Główna Litewska*) and the Main Warsaw School (*Szkoła Główna Warszawska*) were established. Those schools had departments of law and administration, philology and history, mathematics and physics, and medicine. Disciplines at the schools were taught in Polish and Lithuanian (in Vilnius), and the curricula were developed in the spirit of the Enlightenment. Graduates of leading European and Polish-Lithuanian educational institutions worked as professors there. However, after 1789, the supporters of educational reforms in the Sejm of the Polish-Lithuanian Principality began to gradually lose their influence. In 1794, after victory of the Confederation of Polish-Lithuanian Gentry, the Commission finally lost control over most of the educational institutions and many of its members were exiled or fled abroad. This fate also befell Kołłątaj himself, who was forced to emigrate to Dresden. Thus, the Commission ceased to exist (Pasztor, 1991, p. 160). Although the Commission for National Education operated for only a little over twenty years, its significance in the history of Poland cannot be overestimated, as it managed to completely change the form and, to a large extent, the content of education. It can be said that thanks to the Commission efforts, the Polish language and culture did not vanish during the three partitions of Poland (1772–1795) and the subsequent intensive Russification and Germanization of the country.

At the beginning of the 19th century, one of the main factors that contributed to the development of industry in the Kingdom of Poland was the protectionist policy of encouraging foreign industrialists to settle in Polish lands via granting them benefits, privileges and state loans. The rapid growth of cities contributed to the development of industry. In turn, the successful industrialization fostered the emergence of a new social class – the bourgeoisie. Simultaneously, a working class, formed mainly from the impoverished peasants and artisans, began to emerge. The human resource of qualified specialists employed in industry consisted almost entirely of emigrants from Prussia, Saxony and Bohemia. However, due to the increasing pace of industrial development in the Kingdom of Poland, there was an urgent need for domestic specialists who could work in construction, transport, mining and other industrial sectors. By government decision, foreign industrialists were obliged to contribute to the professional development of local workers, mainly the youth (Przybyszewski, 1999, p. 61). So, the system of professional technical education was gradually emerging. The main initiator of this process was the outstanding Polish educator and philosopher Stanisław Staszic. He elaborated the plan for organizing and development of professional training in the Kingdom of Poland, which was approved in 1816 by the newly formed Government Commission for Religious Affairs and Public Education (*Komisja Rządowa Wyznań Religijnych i Oświecenia Publicznego*). The essence of the plan was that schools (which later became colleges or institutes) with polytechnic or special professional orientation (industrial, agricultural, architectural) were separated from universities. Thus, within 1816–1830 there were established: Academic Mining School (*Szkoła Akademicko-Górnicza*, 1816), School of Construction and Land Management (*Szkoła Budownictwa i Miernictwa*, 1817), School of Forestry (*Szkoła Leśna*, 1818), School of Civil Engineering of Roads and Bridges (*Szkoła Inżynierii Cywilnej Dróg i Mostów*, 1823), Agronomic Institute (*Instytut Agronomiczny*, 1820), Preparatory Technical School (*Szkoła Przystawowawczą do Instytutu Politechnicznego*, 1826). Technical sciences were widely studied at the University of Vilnius and the Volyn Gymnasium (Przybyszewski, 1999, p. 63).

Special attention deserves the Academic Mining School in Kielce, established in 1816. It is considered the first Polish higher technical educational institution. Stanisław Staszic was not only the main initiator, but formulated the profile of school's activities and organizational subordination. The school had two missions: firstly, the training of professional engineering personnel for industrial institutions in the mining and metallurgical industries; secondly, the creation of conditions for scientific and research work, the results of which would contribute to modernization of the national industry. The school was an important element of the long-term program for the development of the mining and metallurgical industry of the Kingdom of Poland. The main problem for the school founders was the lack of highly qualified teaching staff in the mining and metallurgical industry. There were few local specialists, so professors were invited from abroad, mainly from Saxony. The curriculum included 14 fundamental and specialized disciplines. The language of instruction was German, but later it was completely replaced by Polish, which was the result of the gradual Polonization of foreign specialists and their assimilation into the new environment. Training took place in two shifts, eight hours a day, and one day a week was free from classes to be intended for visiting mines and factories. After passing the exams at the end of academic year, students went on practical training at industrial enterprises. Having graduated the school, the most capable graduates underwent internships abroad. The school operated for ten years, until in December 1826 (after the death of Staszic) it was disbound. All the educational and scientific assets of the school were transferred to the University of Warsaw. During its short existence, the school graduated a relatively small number of students (41), but they were qualified specialists who later had a significant impact on the development of regional industry (Jasiuk, 2006, p. 16).

The defeat of the uprising of 1830–1831 suspended reformist activities. The manifesto «On the New Order of Administration and Education of the Kingdom of Poland» was issued on February 14, 1832. This document sharply limited Poland's independence: the Polish Sejm and Polish separate military forces were liquidated; the Kingdom of Poland was proclaimed an integral part of the Russian Empire (Manifest, 1832, p. 168; Statut, 1832, p. 173). In 1839, a separate department for education and enlightenment was liquidated, the University of Warsaw and the «Society of Friends of Science» were closed. All professional educational institutions were liquidated. With the closure of the University of Warsaw, all existing professional schools were liquidated as well. So, the function of centers for professional technical training was assigned to gymnasiums, the number of which was also noticeably reduced. Censorship was sharply tightened, many figures of the national movement and enlightenment were forced to emigrate, and the new customs tariff introduced by the Russian government led to a sharp decline in production in Polish industry (Demidowicz, 2010, p. 139).

In 1833, a new (temporary) School Charter was approved. According to it a new type of seven-year gymnasium was introduced, in which, starting from the sixth grade, there was a division into two departments: philological and technical. The technical departments were to replace the disbound technical educational institutions. They taught technical mechanics, general and organic chemistry, technology and economics. At the same time, elementary schools were approved as educational institutions intended for the lower-class representatives and district (*powiat*) schools – for education of the middle-class representatives. According to the School Charter of 1840, district schools were divided into 2 categories: philological schools, which prepared students for the higher grades of gymnasiums, and real schools, which prepared their graduates exclusively for practical activity (Przybyszewski, 1999, p. 64).

Thus, due to the lack of technical schools, the training of specialists for industry was fragmented and unsystematic, which, accordingly, negatively affected the quality of education. As a rule, training was carried out through courses organized directly at enterprises for their own workers. The situation improved in 1841, after opening of the Warsaw Real Gymnasium, which to some extent took over the functions of the former Technical Department of the University of Warsaw. Within four years, a seven-year mining school was opened in Kielce, where students received thorough knowledge of the exact sciences and were well-versed in technical and practical matters. In 1845–46, two higher real schools were opened in Kielce and Kalusz, as well as six county real schools in Włocławek, Marijampolą, Płock, Radom, Lublin, and Łódź. The last two schools had a specialized technical focus. The total number of students studying in real schools in 1845 was 344 people (Przybyszewski, 1999, p. 66).

In 1850, a new plan for the organization of schooling in the Kingdom of Poland was developed. According to this plan, higher real schools were reorganized into schools with a clearly defined professional orientation. Their graduates could not be accepted into administrative institutions, but were only allowed to work professionally according to their qualifications. In addition, county real schools were replaced by vocational schools of a lower level. The elimination in 1851 of the customs borders between the Kingdom of Poland and Russia gave a new impetus to the Polish national industry development and started the gradual revival of the country's higher technical education system. In 1852, the Warsaw Real Gymnasium was reorganized into the technical institute (two

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departments were opened: mechanical and chemical). Ten years later, another higher professional technical educational institution was revived: on the basis of the former Agronomic Institute in Puławy, the Polytechnic and Agricultural and Forestry Institute (*Instytut Politechniczny i Rolniczo-Leśny w Puławach*) was organized, in which, among others, mechanical, chemical and mining departments, as well as civil engineering departments were opened (Dziewulski, 1997 b, p. 32).

However, this revival suffered a severe blow after the defeat of the 1863–1864 uprising. The repressions led to the closure or reorganization of the professional educational institutions, which students took an active part in the national liberation movement. In 1864, Prince Alexander Wielopolski, who headed the Kingdom's tsarists administration, initiated the reforms leading to deterioration of the professional education system. Thus, in 1869 the Warsaw Main School, the Puławy Polytechnic Institute, as well as all county schools were closed. The same year in Łódź, instead of the previously planned Polytechnic Institute, only the Higher Craft School was opened. The chief opponent of the Polytechnic Institute opening was the Minister of Education, Dmitriy Tolstoy, who convinced Tsar Alexander II that Łódź's residents, who were mainly engaged in weaving, did not need higher education at all. In addition, in the period of 1869–1885, the Polish language was gradually ousted from the education system, which led to its being regarded as «optional» (Przybyszewski, 1999, p. 67).

At that time, the process of reforming polytechnic institutes into higher technical schools began in the Austro-Hungarian Empire: Prague (1863), Graz (1864), Vienna (1865), and Brno (1867). In Galicia, these were the Krakow Technical Institute (1834) and the Lviv Technical Academy (1844). At the time of its establishment, the Krakow Technical Institute was the only higher technical professional educational institution in Polish territory. It gave rise to a number of vocational schools and courses, and also became the starting point for all Polish polytechnic education. Thanks to fruitful cooperation with the Jagiellonian University, the departments of mechanics and construction, mineralogy, mechanics and physics were opened. Throughout the institution existence, subjects were taught in Polish. In 1876, the Technical Institute was reorganized into the Technological and Industrial Institute, and in 1886 into the Higher State Industrial School (*Krakowska Przemysłówka*) (Piłatowicz, 1999, p. 91).

The Lviv Technical Academy, established in 1844 on the basis of the Real Trade Academy, had departments of engineering, construction, technical chemistry, and later a mechanical engineering department. In 1877, the Technical Academy was reorganized in the Polytechnic School with the rights of a higher technical educational institution. In 1851, the number of students was only 220, but by the end of the century, the institution ranked second among technical educational institutions of the Austro-Hungarian Empire (after the Vienna Polytechnic). Thus, the Lviv Polytechnic became an important component of the system of European technical science – students from Germany, France, Romania, Turkey and other countries studied there (Szymczyk & Ziębik, 2004, p. 26).

The rapid development of the railway system in the second half of the 19th century increased the demand for qualified workers. In 1873, the instructional workshops were established at the Warsaw-Vienna Railway, where, in addition to practical classes, theoretical technical disciplines were taught. Two years later, technical schools were opened at the Warsaw-Vienna, Warsaw-Terespol and Vistula Railways. These were the middle level professional technical educational institutions, where the basics of physics, mathematics, drawing, mechanics, construction of railway vehicles, and technology of railway production were taught (Przybyszewski, 1999, p. 68).

Some points must be mentioned on the matter of professional education of women in the Polish lands. Until the second half of the 19th century, the educational authorities did not pay due attention to the issue of professional training for women, so the contingent of professional educational institutions of all types and levels consisted entirely of boys. Starting from 1869, the situation began to gradually change. This year, the Handicraft and Industrial Institution for Girls (*Zakład Rękodzielniczo-Przemysłowy dla Kobiet*) was opened in Warsaw. It was the first women's school of a professional orientation, where technical drawing, accounting and typewriting were taught. Within three years similar institutions were opened in Warsaw, Kalusz, Lublin, Płock, Radom, and Włocławek. Besides the handicraft educational institutions, women's vocational schools were being established, in which qualified seamstresses were trained. In 1882, only in Warsaw, there were over 3,600 seamstresses who graduated these schools. The lower- and middle-class representatives mainly attended handicraft and vocational schools, while the girls from bourgeois and noble families gradually showed interest in higher education. But at that time, women were forbidden to enter universities (Przybyszewski, 1999, p. 69).

An important role in the training of qualified technical personnel was also played by various technical societies that appeared in Poland in the second half of the 19th century. The most notable among them were: «The Society for Cultivation and Dissemination of Technical, Industrial and Natural Knowledge» (*Towarzystwo dla Pielęgnowania i Rozpowszechniania Wiadomości Technicznych, Przemysłowych i Przyrodniczych*), «The Society of Graduated Technicians» (*Towarzystwo*

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Ukończonych Techników) and «The Krakow Technical Society» (*Krakowskie Towarzystwo Techniczne*). These societies aimed to stimulate and maintain interest in professional disciplines, popularize technical sciences, and united both certified specialists and people who had just received technical education. In addition, the societies published their own periodicals: «Technical Journal» (Lviv) and «Journal of the Krakow Technical Society» (Krakow) (Piłatowicz, 1999, p. 95).

In 1880–1890, professional technical education in the Kingdom of Poland received a new impetus for development after the adoption of new laws on industrial (1888) and trade (1896) schools. According to the first law, there were three types of industrial schools: four-year secondary technical schools, three-year lower technical schools and three-year craft schools. The only exceptions were weaving and foundry schools, for which only a two-year period of study was provided. Secondary and lower schools were further divided into mechanical, chemical and construction. Graduates of secondary technical schools received technician diplomas right after finishing, while graduates of lower schools could receive their diplomas only after completing a two-year period of work at an industrial enterprise. The main task of craft schools was exclusively the professional training of future workers, so their graduates were not assigned any qualification levels (Kondratyuk, 2020, p. 174).

In 1889, the Russian Ministry of Education entrusted to Alexander Apukhtin – then the Warsaw Educational District curator – prepare a plan for reorganization of vocational schooling in the Kingdom of Poland. According to the plan, 15 vocational schools (total annual budget of 311379 rubles) were opened. Among them – a technical school in Dąbrów Górnych (1889, mining and metallurgy), a private Wawelberg technical school in Warsaw (1895, fundamental and technical disciplines), a Świąbski technical school in Warsaw (1896, construction, mechanics, chemistry), a technical school in Łódź (1899, mechanical and chemical disciplines, weaving), as well as two lower railway schools subordinate to the Ministry of Transport. However, the plan (which had as its main goal the increase in the number of workers directly for production activities) did not change the situation as a whole. The middle-class majority still sought to enter higher technical educational institutions. In 1898, the Warsaw Polytechnic was opened. To make it possible, almost three and a half million rubles of donations were collected from citizens. By 1903, 644 students studied in four departments of the Polytechnic (mechanical, civil engineering, chemical and mining). The emergence of new higher technical educational institution was a significant event not only for industry, but also for the whole system of professional technical education in Polish lands (Przybyszewski, 1999, p. 69).

Having traced the dynamics of changes in the system of professional technical education in Poland within the 16th–19th centuries, and investigated its dependence on the socio-political changes both in the state and the world, we can distinguish the main stages of its formation and development (see Table 1).

Table 1

The main stages of the formation and development of professional technical education in Poland in the 16th–19th centuries

Stage # / Time period	Main socio-political events	Main educational events
Stage #1 (2nd part of the 16th – 1st part of the 18th century)	Founding of the Polish-Lithuanian Commonwealth; new constitution; beginning of the era of elected kings; expansion of the influence of the Jesuit Order in Poland; Union of Brest; uprising led by Khmelnytsky; beginning of the decline of the Polish-Lithuanian Commonwealth	Establishing of the first Jesuit educational institutions (Vilna, Warsaw, Poznań, Pultusk); approval by the Sejm of the establishing the Academy of Exact Sciences at the University of Krakow
Stage #2 (1740–1765)	Election of Stanisław August Poniatowski as king; beginning of political and educational reforms; strengthening of the country's economic development	First educational reforms by Konarski; Warsaw Collegium Nobilium; Warsaw Knights' School; strengthening the position of Polish as a language of teaching and learning
Stage #3 (1765–1791)	Russian Protectorate; Bar Confederation; Liquidation of the Jesuit Order; end of the era of elected kings; First Partition of Poland between Prussia, Austria and Russia	Establishing of the Commission for National Education and the Elementary Book Society; educational reforms by Hugo Kołłątaj; renewal of curricula; emergence of the Polish scientific elite

Stage #4 (1791–1830)	Constitution of 1791; Targowishte Confederation; Russian intervention; 2nd Partition of Poland between Prussia and Russia; Kościuszko Uprising in 1794; 3rd Partition of Poland between Prussia, Austria and Russia; Constitution of 1815; emergence of the Polish bourgeoisie	Establishing of the Main Schools in Kraków, Vilnius and Warsaw; Stanislaw Staszic's plan for the development of professional technical education; establishment of the first Polish professional technical schools in Warsaw, Kielce, and Marimoniec
Stage #5 (1830–1863)	Defeat of the uprising of 1830–1831; Manifesto of 1832; repeal of the Constitution of 1815; the policy of active Russification and Germanization; beginning of the uprising of 1863	Cessation of reforms; reorganization of professional educational institutions; temporary School Charter of 1833; real schools; new plan for organizing schooling of 1850; revival of higher professional educational institutions
Stage #6 (1860s–1890s)	Defeat of the uprising of 1863; abolition of serfdom; Wielepolski's reforms; development of industry and the communication system	Higher technical schools; Lviv Polytechnic; Krakow Higher Industrial School; law on industrial schools; creation of the first technical societies; first women's professional educational institutions; plan for the organization of vocational schools; Warsaw Polytechnic

Conclusions. As a social institution, professional technical education in Poland developed historically due to the significant influence of socio-economic reasons and material production. It evolved in accordance with changes in the organization of all social life at different stages of the country's historical development. It should be noted that the most important period in the general evolution of Polish education was the second half of the 18th century. But the first quarter of the 19th century was crucial for the formation of professional technical education system, when the separation of educational institutions with a polytechnic or special professional orientation began. The most difficult times for Polish professional education were experienced after the defeat of the uprisings of 1830-1831 and 1863-1864. Given the general state of the country's professional technical education system in the second half of the 19th century, it can be concluded that the Russian Empire authorities did not pay due attention to the problem of meeting the personnel needs of Polish industry. The level of professional technical education in the Kingdom of Poland was significantly lower than in neighboring states, and Warsaw was the only center of professional technical schooling. In those parts of Poland that then were parts of Prussia and the Austro-Hungarian Empire, the situation was somewhat better, but even there, professional educational institutions of all levels were concentrated mostly in large cities (Wroclaw, Lviv, Krakow). In addition, representatives of the technical and educational Polish community were forced to overcome constant resistance from the imperial authorities, which pursued a policy of forced Russification and Germanization in the respective subordinate territories.

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