



Modern educational digital competence of future doctors of Poland as a European state

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The emergence of an information society with a high level of digitalization is an effective factor in many changes in the social, cultural, economic and political spheres of life. The digitalization of society is observed mainly in countries where the management of information, quality and speed of information flow are the main factors of competition in the field of economics, trade, medicine, and in the field of comprehensive services and education. The process of digitalization of society is complex and multi-stage, and requires a comprehensive understanding not only of the development and formation of society in a new format, but also the life of society as a whole.

Progress requires new methods of collecting, processing, transmitting and using information, as well as the ability to use information and communication technologies (ICT) in most areas of our lives. It is not just about leisure, it is more about effective functioning in today's world, because modern technologies are becoming more complex, and the dissemination and use of information and information and communication technologies requires users with more advanced competences and skills.

The ubiquity of the requirements for digital competences and competence education of society is indisputable. In many cases, it is almost impossible not to use digital skills, for example, to use updated software in modern computers or electronic

equipment, access to public services, quality education or health care, flight tickets, and so on. Even the way doctors treat their patients is a process that is constantly changing and requires the constant improvement of digital medical competences.

Over the last decade, studying and working in medicine has been increasingly influenced by digital tools. Back in 2016, the World Economic Forum, considering the basic provisions of the digitalization of medicine and education, raised the issue of transition to patient-centered care, which allows citizens to take much more responsibility for their health and the health of their families [1]. In this context, learning digital competences should be as necessary as literacy or computational competences [2].

Digital competence means the ability to use ICT very widely, not only by searching and collecting, but above all by analyzing and creatively processing information. It is also defined as “the set of knowledge, skills, attitudes, skills, strategies and awareness that are required when using ICT and digital media to perform tasks; problem solving; communication; manage information; to cooperate; create and share content; and to create knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflexively for work, leisure, participation, learning and communication” [3].

According to the definition prepared by the European Commission, “digital com-

petence involves the confident and critical use of information society technology for work, leisure and communication. This is enshrined in basic ICT skills: the use of computers to receive, evaluate, store, produce, present and exchange information, as well as communication and the ability to participate in shared networks over the Internet ”[4]. The same document provides more specific information on knowledge and skills: “Digital competence requires a deep understanding and knowledge of the nature, role and capabilities of information society technologies in everyday contexts: in personal and social life, as well as at work. These include basic computer programs such as word processing, spreadsheets, databases, storage and management of information, as well as understanding the opportunities and potential risks of the Internet and communication through electronic means (e-mail, network tools) for work, leisure, sharing information, collaborative networking, training and research. Consumers must also understand how information society technologies can support creativity and innovation, and be aware of the issues associated with the reliability and reliability of available information, as well as the legal and ethical principles associated with the interactive use of information society technologies ”[4].

Nowever, the digital competence situation of the population did not improve radically until the onset of the COVID-19 proliferation crisis. As you know, on March 11, 2020, the WHO announced that the epidemic situation caused by the coronavirus is falling into the category of a pandemic [5]. This situation has seriously affected the education system in the world. As of April 2, 2020, the number of pupils/students who were forced to stay at home due to the closure of educational institutions at all levels reached a peak — 1.484 billion people (86.3% of the total) in 194 countries. Despite the measures taken, at the end of March 2021 in Europe were completely closed schools in Bosnia and Herzegovina, Greece, Hun-

gary, Estonia, Poland, Serbia and Ukraine [6]. In Poland, the first confirmed case was recorded on March 4, 2020, and a state of emergency was declared on March 20 in accordance with the Regulation of the Minister of Health [7]. Polish universities began suspending their studies on March 10, and all universities closed on March 12. Public gatherings were banned, movement of people and access to public places were restricted, and direct social interactions were restricted by a Regulation of the Minister of Health of March 24, 2020 [7]. Thus, fundamental changes were made in the way of teaching for more than 5 million students and 24.5 thousand students in educational institutions. As the Ministry of National Education emphasizes in a special report, Poland is one of the countries that has responded most quickly to the threat of coronavirus infection of students and teachers [8].

The Digital Education Action Plan for 2021–2027 of the European Commission [9] published summarized results of public consultations that took place in European countries from June to September 2020. The Action Plan states that that almost 60% of respondents did not use distance and online learning before the pandemic crisis, and 95% believe that the COVID-19 crisis means not returning to past technologies used in education and training.

Some definitions adopted by the European Commission emphasize the educational context of the competences under discussion. The description of competences is associated with several problems, including the ambiguity of the word itself [10]. The term “competence” is defined and discussed differently depending on the context [11]. Competence-based medical education was defined by Frank and co-authors as follows: “Competence-based education is an approach to preparing physicians for practice that is fundamentally focused on the ability of graduates and organized around competences based on analysis of societal and patient needs. It does not focus on time-oriented learning and promises

greater accountability, flexibility and focus on learning.”[12]. According to this approach, “digital competence is seen as the application of acquired knowledge, skills and attitudes when using ICT to adequately perform a task in a specific context, such as education, work, personal or professional development” [13]. In academic discourse we can find different concepts regarding and naming competences (in a broad sense) of the use of ICT [14, 15]. They are called, among other things, electronic competences [16], electronic skills [17], technological literacy [18], digital competences [19, 20]. The WHO, for example, defines them as “cognitive and social skills that determine the motivation and ability of individuals to access, understand and use information in such a way as advertise and maintain good health” [21]. Not surprisingly, health researchers in the world’s leading countries have criticized the gap between health and education, noting that medical students are not sufficiently prepared to meet the challenges of digital medicine [22]. Despite the fact that students studying medicine today, grew up in the digital age, when the use of smartphones, applications and smart devices is a ubiquitous and irreversible element of everyday life, and the ability to use such devices is not in doubt in personal life, only a small proportion of medical students can, only partially, use their abilities in professional work with patients in medical institutions. In the conditions of constant availability of knowledge on the Internet, training of students of medical educational institutions needs to be adapted to digitalization of a society [23]. This adaptation affects not only future doctors, but also patients who like to communicate with doctors on an equal footing, have their knowledge in this context. For example, more than a third of patients try to diagnose themselves via an online source [24], and web-based symptom screening currently reports more than 15 million monthly visits [25, 26]. Thus, digital literacy is becoming increasingly important, not only in education but also for patients and society itself.

In legal terms, the situation is not very different; it is about data protection or digital communication between doctor and patient, and the protection of the private sphere for personal health information [27].

For Poland, as a member of the European family, digital literacy of doctors is an integral part of catalogs and frameworks for digital competences of doctors. To make full use of data, physicians need to know how digital data can be converted into meaningful information. Have a clear idea of the differences between data, information and knowledge and the relationship between these terms. In addition, all physicians need to understand how they can provide high quality data. In addition, work is being done at the European level — to create a single data protection, instructions on the administrative handling of information about the health of patients in the country.

The purpose of the article is to analyze the features of the formation of modern digital competence of future doctors of medical schools and universities in Poland, which can be considered examples of good educational practice in modern Europe.

As education is one of the most important factors influencing the development of society, it is subject to numerous analyzes. In 2014, the British International Pearson Foundation, which specializes in educational and publishing activities, presented the “Rating of the effectiveness of national education systems”, the so-called “Global Index of Cognitive Skills and Achievements”, conducted research to collect data and analyzation of 40 global education systems where are including Europe, the United Kingdom, West and East Asia, North and South America, Indonesia, Australia and New Zealand [28]. The study has been conducted since 2012 as part of the global project “The Learning Curve”, which combines a wide range of global and international indicators of education in different countries. The authors of the study point out that the results of the project are an attempt to ensure the effectiveness of national education systems among a larger

number of countries at different stages of socio-economic development. The survey does not directly represent the image of the quality of education, but provides data that confirm the existing problems in the information society. According to the European Commission's 2018 report, 19% of Europe's population still did not have digital competences [29]. Among European countries, the Polish education system ranks, according to the data, in fifth place. In the 2019-2020 surveys, Poland's position remains unchanged, and the countries of the Middle East, South Africa, China and India have been added to the data collection.

Poles are one of many examples of societies that do not struggle with galloping technological progress, but flexibly adapt to the digitalization of society. The Ministry of Digital Affairs Poland was established by the ordinance of the Council of Ministers of 7 December 2015, which transformed the former Ministry of Administration and Digitization (the ordinance entered into force on the day of its announcement, 16 November 2015) [30]. The Prime Minister the Minister of Digital Affairs heads the computerization department of the government administration (of 9 December 2015). The aim of the Ministry of Digital Affairs is to enhance Poland's image as an innovative and friendly country and promote a variety of interactions between the state, citizens, entrepreneurs and the business sector. The Ministry of Digital Affairs is helping people better their lives and maximize the impact of digitalization.

According to the European Progress Report on the Digital Sphere for 2016 [31], "Poland ranked 25th out of 28 EU member states in the European Commission's Digital Economy and Society Index (DESI)", which tracks Europe's overall digital performance and tracks EU countries' progress in their digital competitiveness. In the same report, we can read that "in terms of human capital, Poland is working below the nominal index and making moderate progress. Only 40% of people have basic digital skills. About 30% of Poles have acquired ICT skills

through formal education (school, college, university, etc.)". As the DESI rating is prepared regularly, in addition to the current location, it is worth noting the country's progress. DESI has been developed in accordance with the OECD [32]. The data included in the index were mainly collected from the relevant authorities of the Member States of the European Commission (Directorate-General for Communication Networks, Content and Technology, as well as Eurostat) and on the basis of special surveys conducted by the Commission. The European Commission has monitored Member States' progress in digital and annual publications. The Digital Economy and Society Index (DESI) have been reporting since 2014.

Each year, the reports include country characteristics that help Member States identify areas for priority action, as well as thematic sections that provide analysis at EU level in key areas of digital policy. The DESI index was the sum of five main dimensions: connectivity (broadband infrastructure deployment and quality), digital skills (needed to use the opportunities provided by the digital society), Internet use by citizens (various activities that citizens already perform online), integration of business technologies (digitalization of business and development of the online sales channel) and digital public services (digitalization of public services with a focus on e-government) (International Digital Economy and Society Index 2018). In 2021, the Commission adjusted DESI to reflect the two main policy initiatives that will impact the digital transformation in the EU in the coming years: the Recovery and Stability Mechanism and the Digital Compass of the Decade. To align DESI with the four main points and objectives of the Digital Compass, to improve the methodology and to take into account the latest technological and policy developments, the Commission has made a number of changes to the 2021 edition of DESI. The indicators are now structured around the four main areas of the Digital Compass, replacing the previ-

ous five-dimensional structure. 11 DESI 2021 indicators measure progress towards the goals set in the Digital Compass. In the future, DESI will be even more aligned with the Digital Compass to ensure that all goals are discussed in the reports. Given the indicator of human capital (measurement of digital skills), Poles achieve much better results than Germans, Danes and other European countries, each year their score is twice as high. The progress of Polish students in the field of digital competences was noted in a report in 2017, which summarized the results of recent studies conducted by PISA, TIMSS and PIAAC [33], which clearly shows the progress and high efficiency of Polish educational institutions, which compared to most European countries worked in less favorable socio-economic conditions.

During 2020, Poland has made progress on many indicators, but given the no less positive developments in other countries, this has not changed its overall position. In terms of human capital, there are still significant gaps, where Poland ranks 24th, gaining points below the average in most indicators. Although the country has reached the EU average in terms of the percentage of ICT graduates among the total number of graduates, the shortage of specialists has a significant impact on the integration of the digital technology business, preventing it from fully exploiting the potential of the digital economy.

Polish regulations do not provide for a legal definition of the terms “digital health” and “digital medicine” [34]. Thus, the difference between these concepts is a matter of practice and technical differences in regulations. In Polish medical schools and medical universities, the concept of “digital health” is broader, covering:

- actions/products focused on the patient / user; actions affecting health, digital technology and health care;
- the field of digital technologies, namely, public databases containing medical data; databases used not only to diagnose and treat patients and support diag-

nosis and treatment, but also to support, administer and improve the efficiency of health care systems and organizations, and to monitor health care standards. Databases are provided by individual health care providers or research organizations.

The concept of “digital medicine” in the field of health care and medical education in Poland is narrower, which includes the use of the above technologies and concepts to provide medical care to individual patients. The clearest difference between them can be seen in the regulatory requirements — for example, digital medical technology does not meet the regulatory definition of a medical device. However, digital medical products or technologies used by health care providers to provide health care services or process patients’ medical records will be subject to regulatory requirements that apply to health care providers.

In addition, Polish law does not provide a legal definition of the terms “telehealth” or “telemedicine”, but recognizes the general possibility of providing medical services through IT or telecommunications systems. The Law on Medical Activity stipulates that medical activity can be carried out using IT and communication systems. Medical activity is defined as the provision of medical services (activities aimed at maintaining, preserving, restoring or improving health and other medical measures arising in the course of treatment), health promotion, training and research in connection with the provision of medical services and services for health promotion or the introduction of new medical technologies and treatments.

The rise and spread of digital solutions in the field of healthcare and digital medicine in Poland contribute to the coincidence of a number of trends and technologies. Increasing computing power and storage, as well as the availability of cloud storage and cloud computing solutions, make it possible to store and analyze large amounts of medical data, both for digital medicine and for healthcare purposes. Digitization of medical

devices and the use of media (such as smart watches) are leading to the availability of increasing amounts of high-quality digital medical data. The growing use of smartphones, computer access, high-speed and bandwidth Internet and mobile Internet means that people can use telemedicine services. The development of artificial intelligence/machine learning (AI/ML) solutions is based on all these trends.

The COVID-19 pandemic had a major impact on the education system, and Poland had to suddenly switch from inpatient to distance learning. This has increased the demand from students and teachers for equipment, software and digital skills dedicated to distance learning and teaching. In addition, many digital tools and e-learning platforms have had to be rapidly upgraded [35]. Many financial projects were subsequently launched to meet demand and help everyone involved in the transition.

The COVID-19 pandemic in many countries has accelerated these changes in various spheres of society in a very short period of time, and this has had far-reaching consequences for health care and medical training. In 2020, the Government of Poland began work on “The Digital Competence Development Program 2020-2030” [36]. The aim of the program is to constantly increase the level of digital competences, giving everyone in Poland the opportunity to develop according to their needs. In addition, this program should clearly identify specific financial instruments for specific tasks and indicate a clear timetable for their implementation, as well as ensure its coordination with other plans of the “Polish Agreement”. The Ministry of Health’s action plan for telemedicine and e-health is detailed and refined in terms of the pace and spatial scale of its implementation [37]. Poland has introduced a new plan called the Polish Agreement, which aims to reduce social inequality and create better living conditions for all citizens after the COVID period. According to him, the government wants to enable every household in Poland

to have access to broadband Internet by 2024. This means that more than a million households will have broadband Internet access. However, the problem is that the government has not yet presented concrete actions or strategies to achieve this goal. Although such details are necessary, otherwise it will not be possible to achieve another goal, which is the development of the Patient Care Center [38]. This is the next step in digitizing the health care system, which will reduce bureaucracy and allow you to make an appointment with doctors, including specialists, via the Internet or a hotline. A necessary condition for the effective implementation of this goal is to provide Internet access for everyone. Therefore, some adjustments are needed as health policies, and digitization policies, any plans need to be detailed and agreed upon. In addition, they should focus on improving both the digital infrastructure and the digital literacy of patients and providers. Such coordination will increase the efficiency of health care resources and reduce their waste. These challenges will also have to be addressed and addressed by universities and colleges for health professionals in the future.

The US Food and Drug Administration (FDA) claims that the scope of digital health care includes mobile health (mHealth), health information technology, wearables, telehealth and telemedicine, and personalized medicine [39]. Poland has also raised the issue of change in medicine because of the opportunities offered by digitalization. Starting in 2020, all healthcare professionals are required to make therapeutic and diagnostic records in the patient’s electronic medical record and — if the patient has such a card — to take into account the information contained in it when making a medical decision. However, the existence of digital media, such as electronic patient records, is only half the story; the other is how to handle such tools. According to the actions that this transformation brings, there is a significant need to train future doctors in medical education institutions.

To facilitate this, in 2017, Poland launched an initiative, eHealth, in which it identifies various areas of action, one of which is the provision of digitalization, and acknowledged a nationwide lack of skills in this area, stressed the importance of digital competences.

What digital competences should future doctors acquire according to educational organizational decisions, according to The Digital Competence Development Program 2020-2030 (Digital Affairs — Chancellery of the Prime Minister, Poland) [36]. Key issues:

— What types of digital competences of health professionals are needed in the future?

— What impact will data digitization and the relationship between patients and healthcare professionals have on the relationship?

— How should medical education institutions adapt to students' bachelors and further health education to meet the demands of the digital society?

The purpose of educational medical programs in Polish universities is the opportunity to practice medicine in a clinical setting and in academic research. There is an urgent need for future clinicians to acquire digital competences in health care. Accordingly, the number of digital health competences frameworks for medical students at different stages of their education is growing. At present, “digital health courses” are not officially provided in Polish medical institutions. Most of them, according to the recommendation of the World Health Organization, are included in the curricula of medical schools [40]. An analysis of existing research on “digital health courses” for medical students should be useful for curriculum planners to develop and implement such courses [41]. In general, the analysis includes content, duration, pedagogy, learning objectives, course integration, assessment methods, format, delivery and evaluation of reports. Digital medical education must be comprehensive and systematic. Most digital health courses have been

integrated into existing health informatics courses, and have focused on work skills with the electronic patient record (EHR), computer literacy, telemedicine, basic programming and mobile health (mHealth). Computer science courses were offered as optional and compulsory depending on the year of study. Digital competences acquired by students in medical informatics courses included competences in the use of clinical decision support systems, databases, confidentiality and security, medical image processing, biosignal analysis, basics electronic medical records, basics of information technology in medicine, health tracking systems, data management (e.g., storage and retrieval data), information literacy (e.g., formulation of clinical and general medical issues), search of online bibliographic databases, and search for evidence-based resources, information technology communication, multimedia. Courses are provided to students 1-4 years of study. The teaching methods used in universities were: introductory lectures, practical classes, small group learning, e-learning and assigned projects or specific digital formats, such as hackathons, mass open online courses (MOOCs) and forums were also used. In general, computer science courses focus on the knowledge and skills associated with the use of EHR in clinical settings with online health. Problems faced by students attending courses are poor computer skills, incomplete presentation of material due to errors in the learning management system, limited participation, and lack of perceived usefulness of courses as part of preclinical training.

There are several competences that are important for physicians in all medical disciplines. To make full use of data, future physicians need to know how digital data can be turned into meaningful information. According to the discipline of medical informatics, an accurate understanding of the differences between data, information and knowledge and the relationship between these terms is one of the important aspects for students of all

disciplines [42]. In addition, all physicians need to understand how they can provide high quality data. Due to the rapid growth of medical knowledge in modern medicine, it is more important to ask the right questions than to simply gather lexical knowledge [43]. Thus, the management of medical information and knowledge is becoming increasingly important. It should also be noted the digital competences that students acquire in postgraduate medical education, namely: information literacy, information management and security, information systems to support patients and the public, development of the structure and analysis of the medical card including data quality, latest technologies.

Based on the areas of digital medical competences, the curricula taught in Polish medical schools have a course of programs with increasing difficulty. Here, attention was paid to ensuring the organization of various blocks of topics on computer-centered and system-centered content. Both control and final evaluation formats are used as evaluation formats.

In conclusion, it can be said that the acquisition of digital medical competences is now recognized as part of routine training in medical schools in Poland. Answers to the question of what an ideal medical education curriculum might look like, which would reflect the “digital realities” of modern medicine with practical elements and teaching, and study the approach to digitalization and how to handle it, are the ability of students to be attentive and critical for new information and communication methods or medical and technical capabilities focused on the patient and organized around the competences obtained on the basis of the analysis of the needs of society and patients. Competence is defined as the ability to act properly, responsibly and successfully in specific conditions, characterized by a high degree of complexity, novelty or uncertainty, which require high quality solutions. The ability to act in this way is based on a set of complex knowledge, skills, motivational orientation, values and attitudes towards these specific

conditions. Higher education institutions have to deal with this. Instead of different naming and understanding throughout European education, there is one common goal, namely to create the best conditions for the learning process.

Digital skills are the foundation of activity in today's world. It is established that the medical education system should provide ample opportunities for obtaining basic digital competences, and this can be optimally realized only with the acquisition of digital competences by future physicians. The healthcare sector is changing due to the increasing use of digital applications, telemedicine programs or artificial intelligence [44], especially in diagnosis and treatment planning. In addition, modern information and communication technologies allow the use of e-health [45] and individualized medicine. Patients can access information online and access a wealth of personal health data through health care programs. The rapid transition of the Polish healthcare system to the digital healthcare system and the related requirements in the use of digital technologies require future doctors to have significant competences both in training and in the clinical workplace. For example, they must be able to evaluate digital treatment, learn new practical skills or reflect on them. All of these approaches underscore the great importance of digital competences being acquired by future physicians and continuing digital medical education in the future to address the digitalization of medicine and identify it as an important strategic goal.

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