

INTRODUCING ARTIFICIAL INTELLIGENCE IN EDUCATION THREATS AND CHALLENGES (FOLLOWING THE EXAMPLE OF BULGARIA)

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Abstract. Artificial Intelligence (AI) has significantly impacted the world in the last three years with the emergence of the Cognitive Crisis, altering not only the way we communicate but also how we learn and teach. Its influence extends to every aspect of public life, including education. This article explores the concept of artificial intelligence, the current regulatory framework for AI, its growing integration in education, and the potential threats and challenges linked to its implementation in the education sector. By taking an analytical approach to the normative framework of artificial intelligence and examining strategic documents related to its application, the author aims to address the extent to which AI has penetrated education, as well as the possible risks and obstacles associated with its adoption. This analysis involves a comparison between the European Innovation Scoreboard (EIS) and the Summary Innovation Index (SII) of Bulgaria and other EU member states, focusing on the correlation with well-prepared human capital. The article concludes by exploring whether artificial intelligence serves as a universal solution and provides insights on how to incorporate it into education effectively.

Keywords: artificial intelligence; digitalization; education

Introduction

We are living in the world of the new millennium – clearly outlining technological advancements and with the centrifugal force of information characterized just a “click” away. Scientists since ancient times have been trying to automate repetitive actions, which in its naturalness artificial intelligence has the task of making everyday life easier for the average person. This is made possible by semi- or full intervention of robotic software, which minimizes the likelihood of potential errors. The definition of the 21st century as the era of new technologies is no coincidence. The 2020 pandemic was that catalyst that provided the impetus for the uptake and use of virtual learning tools (Anderson, Rivera Vargas 2020). Digitalization is pervasive in every field, including education (Andriushchenko et al. 2020; Gafurov et al. 2020; Minina, Mabrouk 2019; Zizikova 2020). Through digital tools used from a young age, the

socio-economic relevance and at the same time the effectiveness of knowledge is increased (Undheim 2022). The process of developing and delivering modern, intelligent education services must meet the ever-increasing demands on the learning environment and the education system. (Krasteva, Todorov, Stoyanov 2019).

According to Nisheva and Shishkov's definition, artificial intelligence (AI) or in English translation artificial intelligence (AI) is "the intelligence demonstrated by computers, as opposed to the natural intelligence manifested by animals and humans. The science of the concepts makes it possible for computers to perform tasks that can be viewed as intelligent (Nisheva M. & D. Shishkov, 1995). The first evidence of the use of the term "artificial intelligence" emerged in 1956 along with the emergence of such a scientific discipline, and so did "the technological phenomenon of modern intelligent systems, which with a certain degree of autonomy take action to perform the tasks set for them" (Council of Ministers of the Republic of Bulgaria, 2020). For the origin of the term "artificial intelligence", the European Union refers to an event in the 18th century when the inventor Kempelen created a machine to play chess. Although it is later found that it hides a human, it is a telling example of thinking towards integrating intelligent machines in the future (European Union, 2023).

The European Commission (EC), for its part, puts forward the following interpretation of artificial intelligence as "a set of technologies that combine data, algorithms and computing power" (European Commission, 2020). The European Parliament (EP) defines it in a 2020 article as "the ability of a machine to demonstrate abilities inherent in humans – to reason, learn, plan or create" (European Parliament 2023). It is important to note that artificial intelligence operates on the basis of a sufficient amount of information to solve a task. He can analyze the environment and take actions that increase the possibilities of achieving certain goals (Russell 2003). Some of the ways it could be done are through facial or speech recognition, intelligent voice assistants, sensors, drones, x-rays, voice recognition, as well as description, picture, etc. Thus, artificial intelligence builds and predicts based on algorithms future actions of the user.

Artificial intelligence is the most common and we can classify the different types of software - whether it is a phone application, chatbots, virtual assistants, imaging, security systems, video surveillance, agriculture, environmental protection, advertising, healthcare, and many more. As a species, according to authors Kaplan & Haenlein, AI is categorised into different systems such as: analytical, artificial intelligence (incorporating emotional intelligence), and human-like AI (Kaplan & Haenlein 2018).

If a decade or less ago someone had said that we would be talking to a machine on the phone or that an artificial intelligence would be conducting our job interview, it would have sounded along the lines of fantasy. It is envisaged that in the future all physical products will be able to connect to the ubiq-

uitous communications infrastructure (Klaus 2017). But artificial intelligence is now so close to us and encompassing all areas of life – manufacturing, e-commerce, healthcare, finance, security, digital platforms, energy, and more – that it is impossible to remain passive in this process. The importance of digital technologies, including the inevitable entry of artificial intelligence into our economy and society, is growing. While its advantages are being proven every day in different spheres of life, artificial intelligence can support the digital revolution that has begun in the educational sphere without leaving the role of the teacher “in the shadows”. It is the identification of the impact of AI in education that is the focus of this paper. The main aim of the study is to argue its views on the chosen topic by examining the increasing use of AI in our environment and more specifically in education.

Results

The study’s results show that the penetration of AI in every sphere of life is in process and education is one of them. Comparing the innovation index among the EU member states and Bulgaria’s position and categorizing them into four groups, it shows a clear link with how open a country is to innovation.

The main research questions addressed in this paper are:

- How far has artificial intelligence penetrated education?
- Possible threats and challenges to the use of AI in education.

Methodology

In the course of the research, the analysis of foreign practices and the comparative analysis of the Summary Innovation Index and the European innovation scoreboard will be used as a methodological basis. The constraints imposed are along two lines: temporal – the period 2019 – 2023 is considered and territorial – most of the research is done in Bulgaria, making comparisons with other EU member states.

Normative framework of artificial intelligence

Artificial Intelligence has transformed teaching irrevocably and in doing so has generated change embedded in the way we teach – examples of which include: the flipped classroom, blended learning, etc (Al Braiki et al. 2020; Roschelle 2020 et al. 2020; Zhang et al. 2019). The sensation that AI-technology has created in the field of generative artificial intelligence over the past year is undeniable. According to Fast company (How artificial intelligence is changing education, 2023) the role that artificial intelligence can succeed where other technologies fail in the following aspects:

- smarter capabilities – manifested in the ability that AI-tech’s results in terms of gaining professional qualifications and various exams have improved in recent months;

- reasoning technology – while ordinary search engines are in the position of a library, these platforms are advanced to analyze, process, synthesize content to the highest degree, similar to human thought;

- unprecedented scale – driven by leading tech giants like Google, Microsoft, and OpenAI, blazing a trail with the rapid creation of new products and companies;

- teaching – thanks to their systems for understanding, respectively generating text close to human, they can give clarification, guidance and feedback according to the needs of a given student;

- teacher's assistant – artificial intelligence can be a teacher's override in performing routine administrative activities in order to focus on teaching;

- student assistant – AI can provide feedback based on written work and, through constructive criticism without being subjective, improve writing skills.

The possibilities of AI in terms of the educational process have their limitations – they could not displace the professional experience of the teacher and his expertise in the field. However over time, in the near future this will likely be refined. Artificial intelligence is an important component of the EU's digital transformation strategy and as such the European Parliament identifies the following key characteristics (European Parliament, 2023):

- digital transformation is the integration of digital technologies by enterprises and the impact of technology on society;

- digital platforms, the Internet of Things, cloud computing and artificial intelligence are some of the leading technologies;

- these technologies are transforming every sector of the economy – energy, transport, agriculture and food production, telecommunications, financial services, manufacturing, and healthcare – while changing the way we live;

- technologies aim to optimise production, reduce both emissions and waste, and create new services and products to make businesses more competitive.

As early as May 2021, the European Parliament adopted a report on Shaping Europe's digital future (European Commission, 2021), in which the leading components and targets set out in the European Commission's 2030 agenda overlap. To a digital decade for Europe, the focus is precisely on developing digital content skills, developing technologies with artificial intelligence, and supporting innovation. The areas of high importance are:

- better healthcare, security, and protection when using big data in the digital domain, the growing impact of technology in the economy and society;

- cybersecurity;

- digital skills and education – the need to handle new technologies has particularly increased during the pandemic, which in turn has triggered a strengthening of these skills. According to the EU, 42% of people lack basic digital skills (European Parliament, 2023);

- online platforms – promoting innovation in the field while protecting freedom of expression and strengthening security;

- addressing the shortage of microprocessors;
- online video games – protecting consumers and supporting the sector;
- European digital identity – easy access to key online services;
- fair taxation of the digital economy;
- financing digital transformation.

The main normative document, in line with the requirements of the European Commission, shaping the overall vision for the development of artificial intelligence in the country and seen as a driver for achieving digital transformation, competitiveness and high quality of life, is the Concept for the Development of Artificial Intelligence in Bulgaria (CDAIB) by 2030 (Ministry of transport, information and communications, 2020). Its main objective is to create innovations by improving the education and lifelong learning system based on building modern infrastructure (European Commission, 2020). The measures that are of paramount importance for the development of AI in Bulgaria that would contribute to the development of knowledge, skills, and competences in the field are (Ministry of Transport, Information Technology and Communications, 2020):

- building a reliable infrastructure for AI development – through investments in building, maintaining, servicing, and aggregating large data sets, as well as in digital innovation hubs;
- developing research capacity for scientific excellence – by bringing together more research units in the country and synchronizing them to improve scientific capacity and develop cutting-edge technologies;
- raising skills and awareness for the use and development of AI - with the following measures being specified in the field of secondary education:
 - acquire basic digital skills (including analytical and applied skills) to create and apply AI;
 - increasing the competence of students in the part related to the ethical norms of the information technologies they use;
 - use of AI products in education while respecting and protecting children's fundamental rights;
 - supporting investment in innovation for SMEs;
 - raising the awareness of the citizens of the Republic of Bulgaria about potential abuses in the use of AI, respectively prevention against it;
 - establishing a regulatory framework for the development and use of AI, in line with international regulations and with current European standards.

Another important strategic document developed in 2020 by the Ministry of Education and Science – Ideas for the development and use of AI in education and science in the Republic of Bulgaria, corresponding to the mission and vision of our country to develop in the direction of AI, big data and robotics. (Ministry of Education and Science, 2020).

Artificial intelligence in education

The rapid development and increasing penetration of artificial intelligence in various forms into our daily lives is already a fact. Therefore, it is necessary to develop learning management systems, assessment tools, and other mechanisms to facilitate its exploitation (Al Darayseh 2023). However, there is still a negative opinion among some teachers about the implementation of innovative teaching methods, respectively they are reluctant to use them (Hébert et al. 2021; Tallvid 2016). According to a study by autor Wang (Wang et al. 2021) in which the five factors of self-efficacy, anxiety, expected utility, ease of use, and attitude towards AI were identified, it was reported to have contributed to 70.4% of the changes in behavioral intentions and provided positive direction for the adoption of AI-based applications. It changes the way we perceive information in the world around us.

The educational sphere is undoubtedly one of the main “engines” for the development of modern society and as such we are witnessing how the applications of artificial intelligence are reflected in this. These can be represented as: learning platforms – Chatbot (Okonkwo & Ade-Ibijola 2021), assistants to monitor each student’s progress (Du Boulay 2016) through learning resources using multimedia to stimulate student learning (Rahayu et al. 2022) to helpers in the learning process itself (Gayed et al. 2022; Kangasharju et al. 2022), tailored to the behavioral and individual needs of a given student. The use of artificial intelligence in the classroom has not yet reached its peak levels. In addition, there is the issue of the ethics of using AI and the individual student’s awareness of what they can and cannot do when using it, how to collect and use data, etc.

This raises questions about the existence of a legally regulated framework to govern the use and creation of AI applications by producers and consumers, as well as steps to address any problems that arise. The European Commission has already proposed in 2020 a unified approach to the development of AI technologies based on the following three elements:

- supporting innovation and promoting the uptake of new technologies;
- preparing for the resulting socio-economic changes;
- providing an ethical and legal framework for the development and deployment of artificial intelligence (Ministry of Transport, Information Technology and Communications, 2020).

According to the data of Council of Ministers of the Republic of Bulgaria, three areas of AI can be distinguished – AI enablers, AI developers and AI consumers. Strongly represented is the share of consumers of AI, which includes various business sectors (occupying 50%) related to the mechanization of repetitive activities, respectively a good prerequisite for the implementation of AI in their processes (Ministry of Transport, Information

Technology and Communications, 2020). The remaining 50% is shared equally by the other two groups – those developing and those creating AI. While the developmental area, representing 25%, is concerned with increasing the number of scientific advances and stimulating publicity resulting from AI research, the remaining 25% is taken up by the enablers of AI (fig. 1). It has two components: a legally regulated framework and education and lifelong learning. They are critical to developing artificial intelligence and its practical applications in all other fields (Ministry of Transport, Information Technology and Communications, 2020).

Several metrics can be used to properly analyze the state of AI, which measures and contains elements of innovation activity. These could be:

- United Nations Human Development Index (Human Development Reports 2022);
- The Global Innovation Index defined by the World Intellectual Property Organization (Global Innovation Index 2022);
- Community innovation survey according to the European Innovation Scoreboard (EIS, 2023), which covers data of each EU member state regarding innovation activities in enterprises (including goods and services, and innovation as such).

For this paper, the European Innovation Scoreboard (EIS) will be examined and in particular, the changes of Bulgaria compared to some of the EU member states in the period 2018 – 2023. The combination of quantitative and qualitative characteristics of each of the 76 indicators confirms the reliability of the index. Another reason for choosing the EII is that it has provided information for the whole EU since 2008, which establishes it as significant in the data presented. According to the European Innovation Scoreboard (European Commission 2023) our country for 2023 is defined as an emerging innovator with 46.7% of the EU average. In this sense, our performance relative to the EU level (8.5%) is growing at a lower rate. In comparison, in 2019 our country is represented with 44.8% and again falls into the category together with neighboring Romania of Modest Innovators with a performance below 50% of that of the EU (European Commission 2023).

The data in Figure 1 shows that Bulgaria ranks with an index of 36.2, which is close to that of Slovakia (36.6), but still far from the EU average of 52.7. As a positive point, it can be noted that after us in the ranking are Poland (34.9), Spain (33.4), Hungary (32.7), Latvia (32), and lastly Romania – 10.7. Interesting is the positioning of Turkey and the overtaking index against Bulgaria – 38.5. The best represented countries are Greece (72.6), Belgium (71.3), Norway (69.6), Germany (68.8), Finland (68.7), Cyprus (65.8) and Sweden (65.2) (Eurostat 2023).

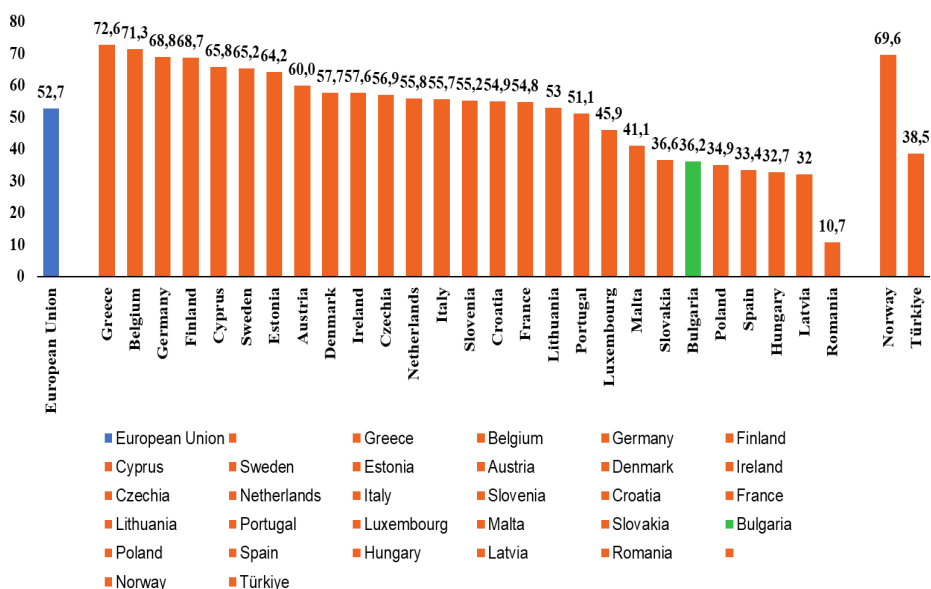


Figure 1. Share of innovative enterprises in Europe 2018 – 2022

Source: Eurostat data https://ec.europa.eu/eurostat/databrowser/view/INN_CIS12_BAS__custom_4964249/bookmark/table?lang=en&bookmarkId=a49a9534-1762-4bc0-ae87-14ceb6a48924

For comparison, the author has also considered the Summary Innovation Index (European Commission 2023) (Table 1), according to which countries can be distinguished into four groups: leaders, strong innovators, moderate innovators and emerging innovators. Traditionally, the Scandinavian countries are the most strongly represented in the ranking – Denmark – with the highest index for 2023 – 149, followed by Sweden – 146, Finland – 146, the Netherlands – 140 and Belgium – 136. As strong innovators, the data points to Austria (130), Germany (128), Luxembourg (127), Ireland (126), Cyprus and France – equally – 114, performing above the EU average (108 for 2023). In the category of moderate innovators are countries such as Estonia, Slovenia, Czech Republic – the closest to the EU average – between 102 and 107, Italy, Spain, Malta, Portugal, Lithuania perform between 91 and 98, and our neighbour Greece is in the penultimate place with an index of 86 for 2023. and Hungary – 76. The penultimate place for 2023 is given to Bulgaria in the “emerging innovators” column with an index of 51, ahead of Romania (36). It is interesting in this

case that developed countries like Croatia, Slovakia, Poland and Latvia are also identified as emerging innovators.

Cyprus underwent the biggest transformation in the measurement of the Summary Innovation Index in the five-year period under review. In 2019, it is among the moderate innovator countries with an index of 85, increasing its development by 29 units in just 5 years (114 – 2023), which pushes it into the ranks of the strong innovators and thus becomes the only EU member state to change its category in the period under review (Table 1.). Another significant change is seen among the Czech Republic and enviable increase of 20 units (from 83 – 2019 to 103 – 2023), Croatia – by 15 units (60 – 2019 to 75 – 2023) and Greece – by 14 units (from 72 in 2019 to 86 in 2023).

Table 1. Dynamics of change of Summary Innovation Index (SII) for EU member states during 2019 – 2023

Country	2019	2020	2021	2022	2023	Amendment
Denmark	138	140	145	146	149	11
Sweden	138	138	145	147	146	8
Finland	133	134	138	142	146	13
Netherlands	137	138	135	139	140	3
Belgium	130	128	136	137	136	6
Austria	124	124	125	129	130	6
Germany	122	122	127	129	128	6
Luxembourg	130	129	126	126	127	-3
Ireland	123	121	118	122	126	3
France	114	115	113	116	114	0
Cyprus	85	89	108	114	114	29
European Union	103	104	106	108	108	5
Estonia	96	99	114	118	107	11
Czechia	83	86	89	92	103	20

Slovenia	92	92	96	100	103	11
Italy	90	93	102	104	98	8
Spain	90	92	92	93	97	7
Malta	94	96	99	96	93	-1
Portugal	94	97	88	90	93	-1
Lithuania	82	84	82	87	91	9
Greece	72	75	81	86	86	14
Hungary	67	68	70	74	76	9
Croatia	60	62	70	74	75	15
Slovakia	66	67	66	67	71	5
Poland	59	58	61	63	68	9
Latvia	56	56	55	56	57	1
Bulgaria	46	47	45	45	51	5
Romania	32	34	37	38	36	4

Source: Private data (from EC, SII, 2023, <https://ec.europa.eu/research-and-innovation/en/statistics/performance-indicators/european-innovation-scoreboard/eis>)

It's important to note that Bulgaria performs well in relation to the Summary Innovation Index (European Commission 2023) and this can be seen from figure 2, where the ratio between the country and the EU average is shown. In the period 2019 – 2023, our country is ranked second to last before Romania, with an index of 46 in 2019 and 51 in 2023. The 5 unit increase achieved is not insignificant, as after the pandemic, there is a decline in 2021 and 2022, to the tune of 45, followed by a 6 unit jump in 2023 to reach values of 51. Despite the country's targeted policy towards the creation and development of innovation activity, Bulgaria remains below 50% of the EU average in the period under review (fig. 2).

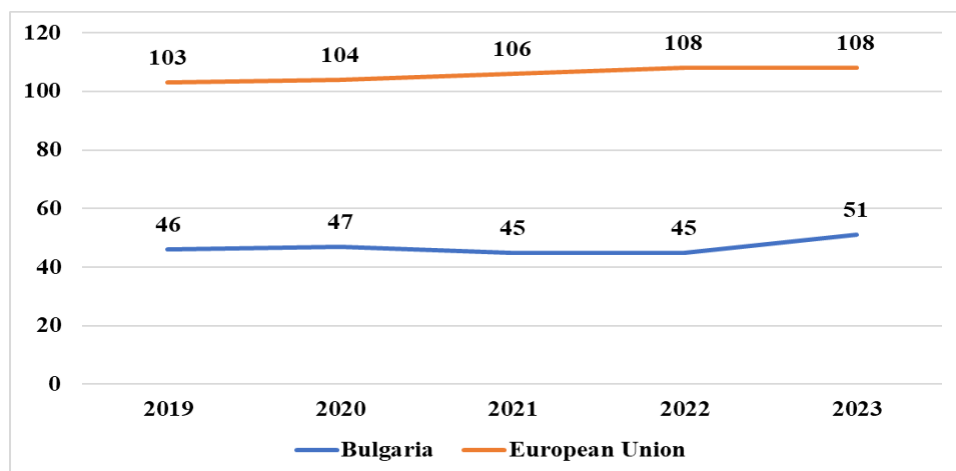


Figure 2. Change in the Summary Innovation Index (SII) of Bulgaria and the EU for the period 2019 – 2023 (by location)

Source: Private data (from EC, SII, 2023, <https://ec.europa.eu/research-and-innovation/en/statistics/performance-indicators/european-innovation-scoreboard/eis>)

The key to the successful implementation and use of artificial intelligence in education is the availability of quality and well-trained human capital, familiar with the latest trends in the field and able to apply them in training. In this regard, Bulgaria should focus its efforts on collaboration and greater participation in international programmes in order to bring the country to the forefront of mathematical and engineering sciences. Stimulating the establishment of joint programmes with foreign universities is also a priority in order to create best practices in training and introducing basic courses in artificial intelligence (European Commission 2023). Finland has produced public slides of a course on basic AI concepts (European Information Technologies Certification Academy, 2023), which will be available in all official EU languages, and plans to develop and roll out a series of courses based on this. And last but not least, the university-business relationship should be strengthened in order to provide quality training for highly qualified future specialists who meet the current labour market situation.

The use of artificial intelligence invariably raises security issues. Therefore, in 2019, the European Commission published the following requirements that AI applications should comply with (European Union 2019):

- human factors and supervision – AI systems should not impair human autonomy or cause other adverse consequences;

- technical robustness and safety – the physical and mental safety of AI systems should be verifiable at every stage by all parties involved;
- data governance and privacy – data must be free from inaccuracies or errors and not reflect social bias;
- explainability and transparency – to record and document both the decisions made by AI systems and the entire process that led to those decisions;
- diversity, non-discrimination and equity – to ensure universal design for equal access for persons with disabilities;
- societal and environmental well-being – to monitor the social impact of AI as well as the sustainability and environmental responsibility of AI systems;
- accountability – to ensure responsibility and accountability for AI systems and their outcomes, minimising potential negative impacts.

The use and penetration of AI in our daily lives should not make us lazy and passive in our actions, but on the contrary – it should be used to support human activity based on fundamentals in strict compliance with the ethical norms of society.

Threats and challenges to the use of AI in education

The use of artificial intelligence, to one degree or another, brings with it some questions whose answers are still “hanging” in space. One of them is who would be responsible if a problem occurred. For example, it reveals the question mark surrounding privacy for PNAs who are prone to misconceptions (Nazaretsky et al. 2021). Another knotty point is a possible threat as a result of an AI-made response based on ethnicity, gender, age, or some other decision; privacy and sensitive personal data, and last but not least, manipulating public opinion by creating false echo chambers, fake videos and even rigging elections.

Already a report of the European Parliament in 2020 talks about the opportunities and threats associated with the use of artificial intelligence and how it is increasingly entering our lives (European Parliament 2023). In this sense, the creation of a regulatory framework regarding AI would contribute “to the development of the technology and the protection of consumers on the consumer side” (European Parliament 2023). At a meeting in Brussels in May 2023, Alphabet’s CEO assured EU Internal Market Commissioner Thierry Breton that AI products and services are being developed responsibly and even suggested an “AI Pact” be created. At its core is the idea of being the equivalent of the International Atomic Energy Agency to regulate “superintelligent” artificial intelligence and protect humanity (Profit 2023). Its aim is to comply with content creation, copyright and related EU rules on this following increased attention from researchers about possible risks in using AI. It is no coincidence that the US-based Center for Artificial Intelligence Safety (CAIS) is “working to mitigate the risks that artificial intelligence can pose globally” (Profit 2023).

Technological developments in the field of artificial intelligence, digitalization and stimulating investment towards AI research require a close relationship with the education sector to provide the necessary digital knowledge, skills, and competencies. There are three main types of challenges in education and they are in the following order (European Union 2018):

- the most significant challenge is to prepare society by developing basic digital skills;
- supporting those people who are likely to drop out of the labor market due to automation, artificial intelligence, or robotics;
- focus on training more and more ICT professionals.

The Digital Education Action Plan (2021 – 2027) (European Commission 2023), adopted in September 2020, aims to address post-code challenges and present more opportunities in education. It is identified by two strategic priorities and their associated fourteen actions (European Union 2022). Priority 1 aims at fostering the development of a high-performing digital education ecosystem, while Priority 2 concerns the enhancement of digital skills and competencies in digital technologies. While the former is concerned with creating an appropriate environment and regulatory framework for the development of digital education, the latter is practically oriented. An example of this is Action 10 of Priority 2, which regulates the improvement of digital skills provision in education and training (European Commission, 2020). In its annual report on the state of digital skills, the European Commission pointed out that only a third of Bulgarians have basic digital skills between the ages of 16 and 74 (31% for Bulgaria, compared to the EU average of 54%) and only 8% have digital skills above basic (European Commission 2023).

To foster the development of a high-performing digital education ecosystem, implementations with the following parameters are needed:

- infrastructure, connectivity and digital equipment;
- effective planning and development of digital capacity;
- teachers and staff in education and training who are competent in digital technologies and use them confidently;
- high-quality content, easy-to-use tools and secure platforms.

To enhance the digital skills and competences needed for the digital age:

- support for the acquisition of basic digital skills and competences from an early age, including: digital literacy, computer education and a good knowledge and understanding of technology (including AI);
- increase advanced digital skills by increasing the number of professionals in the field as well as the proportion of girls;
- participation in more European skills development programmes;
- lifelong learning;
- stimulating teachers to integrate the use of digital technologies in the classroom.

One of the most recent documents written in 2022 to improve awareness of AI and its conscious application is the Ethical Guidelines for Educators on the Use of AI and Data in Teaching and Learning (European Commission 2023). They will support on the one hand the work of educators – in the part to understand the scope of data used and the applications of AI that there are in education, and on the other - awareness of possible risks. The document stresses that AI has no role in education to the extent that everyone “should be able to contribute to and benefit from the development of AI” (European Commission 2023). Importance is also given that the role of the teacher cannot be displaced and the focus

remains on his/her core duties – teaching, developing capabilities through effective collaboration with AI, encouraging creativity and problem-solving. Even the idea of AI replacing the teacher altogether is creeping in (Selwyn 2019). In this context, we should consider how education will prepare the future workforce for the labor market in line with predictions that AI will automate many jobs. Concerning the arguments presented, it can be concluded that although technology, and in particular artificial intelligence, has reached a wide audience, including educational audiences, its application should be for teaching purposes. Otherwise, the words of Antoine de Saint-Exupéry “...it seems that the machine removes us from nature. And it is she who subjects us to the eternal laws of nature with peculiar severity,” hopefully not prophetically.

Conclusion

The society of the 21st century identifies with its opportunities for development through its strongest lever – that of education. In his 2020 publication of the UNESCO Institute for Information Technology in Education (UNESCO IITE), Mr. Stephen Duggan said: “*Artificial intelligence (AI) will play a key role in realizing the promise of personalized learning – the ability to tailor teaching, content and pace of learning to the specific needs of each student.*” (UNESCO 2020). This education training is expressed through: the acquisition of knowledge and skills related to artificial intelligence, goal and result orientation, including exchange of best practices. Its integration should respond to the latest developments and trends of modern society and be part of the education transformation. The curricula should be updated in line with the implementation of the strategic goals of the country in the direction of AI development, paying attention to the key school-university-business link. An example of good innovative practices is the development of school STEM environments, where the focus is on learning and teaching in specially equipped STEM centers – according to the Ministry of Education and Science, there are over 548 schools with innovative school status in Bulgaria (Ministry of Education and Science 2023), and in 2023 the aim is to build over 2200 STEM centers in the country (Darik news 2023). It is teachers’ trust in the technology itself that plays an important role in the adoption of AI (Bittencourt et al. 2020). Building trust in this direction will be realised when there is evidence of the security of the system as well as recommendations from experts and competent organisations. The increasingly ubiquitous functions of artificial intelligence and its application in education should not be seen as a panacea to achieve a better level of education, but by maintaining the focus of traditional education through innovative educational technologies to meet modern demands.

“Education is not preparation for life – it is life itself.”

American philosopher and educational reformer John Dewey

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