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AI TECHNOLOGIES IN EDUCATION: Regulatory frameworks at the international, regional and national level[**]

Abstract: *Artificial Intelligence (AI) has the capacity to transform education and generate a new learning paradigm. The multidimensional process of integrating AI in education entails various technological, economic, legal, social and pedagogical issues. This research paper explores the regulatory frameworks on AI technologies at the international, regional and national level, focusing on documents related to AI use in education. The first part provides an insight into the broad AI conceptual framework and AI-related terminology. The second part provides an overview of documents on AI adopted at the international level (OECD, UNESCO), regional level (EU, CoE) and national level (Serbia), with reference to documents aimed at shaping the use of AI in education. The third part outlines the benefits/opportunities, drawbacks/challenges, concerns/risks and key considerations in the process of integrating AI in education. Based on the research findings, the paper points to the importance of a balanced, human-centered and pedagogy-driven integration of AI technologies, based on carefully designed regulatory framework in line with the highest ethical principles, pedagogical standards and guaranteed human rights. Relevant infrastructure, resources, support, guidelines, and practical training on AI literacy and competencies are essential for transparent, responsible and safe integration of AI in education.*

Keywords: *Artificial Intelligence, AI technologies, regulatory framework, ethical principles, education.*

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[**] This paper presents the AI regulatory frameworks on AI in education at the international, regional and national level. The use of AI in legal education and the results of a survey on this matter will be presented in a separate paper.

1. Introduction

The rise of Artificial Intelligence (AI) has generated a paradigm shift not only in digital technology but also in different areas of life, including education. Prolific AI technologies have changed the ways of accessing, managing and processing data. AI systems can swiftly analyze huge amounts of data, perform complex tasks, improve efficiency, accuracy and performance, generate new content and solutions. Despite indisputable benefits, the use of AI technologies has revealed possible risks and raised various AI-related technical, social, legal and ethical issues.

In response to the growing concerns, international, regional and national institutions have attempted to map the AI conceptual framework, identify issues to be addressed and establish a regulatory framework to ensure responsible and ethical application of AI technologies. In the field of education, international and regional institutions adopted a number of relevant documents which should be taken into account in the process of creating national AI policies, regulations and guidelines, and integrating AI in instructional design for specific educational purposes. Considering the controversy underlying this complex subject matter and different perspectives of the general and professional public alike, there is a need to cast more light on AI technologies and their use in educational, professional training/development and scientific research contexts.

2. The Conceptual framework on Artificial Intelligence (AI)

Artificial Intelligence (AI) has been the buzz word in the past few years but AI history shows that the grounds for developing 'intelligent machines'[1] were laid in the 1950s.[2] The term *"artificial intelligence"* was coined in 1956 by the pioneers in AI research and initially defined as "the science and engineering of making intelligent machines" (Miao, Holmes, Huang, Zhang, 2021:6). Researchers note that there is no single definition but there are working definitions mapping its multiple dimensions (Samoili, López Cobo, Gómez, Prato, Martínez-Plumed, Delipetrev, 2020:7).

Artificial Intelligence (AI) is a generic term for: a) a branch of "science and a set of computational technologies" (Stanford Uni, 2016:4); b) a machine-based system devised by humans to mimic "human-like cognitive functions" (OECD, 2017:22); c) AI-powered systems which can observe the environment, collect and analyze structured/unstructured data, calculate correlations, facilitate

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[1] Alan Turing's test (*the Imitation Game,*1949) mapped the features of "intelligent" machines": a) store and represent knowledge; b) communicate in natural language; c) demonstrate automated reasoning; d) learn from data and environment (machine learning) (Kok, Boers, Kosters, Putten, Poel, 2009:2).

[2] *See:* TechTarget (2024). The History of Artificial Intelligence: Timeline (accessed 10.10.2024).

processes, predict solutions, learn from data/interactions, propose decisions and perform complex tasks in physical/digital environments with varying degrees of autonomy (EC/AI HLEG 2019:36)[3]; d) "the capacity of machines to exhibit or simulate intelligent behaviour" (OED, 2023).[4]

AI technological developments engendered a broad *AI taxonomy*. The understanding of different types of AI is essential for non-expert users in terms of making informed decisions on the choice of appropriate AI system for intended purposes. It is particularly important in the context of education, which entails many stakeholders (competent authorities, institutions, designers, providers, management, tech staff, teachers, learners, parents), highly sensitive educational/training processes and vulnerable users/learners. Thus, technology-wise, AI systems are classified according to different characteristics: technical capabilities[5], functionality and adaptability[6], autonomy[7], knowledge modelling[8], intended purpose[9], and security and risks.[10]

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3   To this effect, *algorithms* (sets of coded rules) are trained on large datasets by using artificial neural networks to learn from data and create *AI models (*programs) to perform tasks and generate new content (ISO, 2024; IBM, 2024).

4   OED/Oxford English Dictionary (2023). Artificial Intelligence, OED (online), accessed 10.10. 2024.

5   In terms of capacities: a) *Narrow AIs* are trained to perform pre-set tasks; b) *General* AIs learn from data and perform tasks without human intervention; c) *Super AIs* exceed the cognitive abilities of humans (IMB,2023).

6   As for functionality and adaptability*:* a) *reactive machines* use pre-defined rules but cannot learn from data (e.g. chatbots); b) *limited memory AI systems* learn, make decisions, adapt to new situations (self-driving cars); c) *theory of mind AI systems* are perceptive, intuitive (recognize human emotions, solve problems, make decisions); d) *self-aware AI systems* have human-like consciousness, emotions and world experience (ISO, 2024).

7   As for autonomy: 1) *assisted AIs* perform pre-set tasks without learning from data; 2) *automated AIs* use pre-defined data to automate tasks without adapting to new situations; 3) *augmented AIs* enhance performance based on human prompts; and 4) *autonomous AIs* act autonomously without human intervention (Rao, Verweij, 2017:2).

8   As for knowledge modeling: a) *rule-driven AI models* use limited structured data and pre-defined (*if-then*) rules to assist in automated tasks (IBM, 2024); b) *model-based* AI are assistive, predictive, pre-trained to perform but need human intervention (TeachAI, 2024:5); c) *data-driven or learning-based AI models* use trained algorithms to learn, interact, generate content, autonomously improve without human intervention (Stanford University, 2016: 9).

9   In terms of *intended purpose: predictive AIs* use processed data to analyze patterns/ performance, assist in tasks, predict outcomes, but they need human intervention; *generative AIs* (ChatGPT) are advanced, adaptive, data-driven models trained to define their own rules and generate new outputs without human intervention (TeachAI, 2024:5).

10   In terms of *security and risk management*, there are: a) *unacceptable risk systems*; b) *high-risk syste*ms; c) *limited-risk* systems; and d) *minimal ris*k systems (EU AI Act, 2024). In

In addition to types of AI, non-expert users should be aware of the basic terminology and how AI systems work. It is crucial for understanding possible technical, educational, social and practical issues when integrating AI at the national, institutional and personal level. Thus, we may briefly refer to the key *AI technologies* which are used in the latest AI models: text mining, computer vision, natural language processing, language modelling, machine learning, deep learning, robotics, Internet of Things, crowdsourcing, AI-based services (Samoili, *et al.* 2020:9).[11]

3. International, regional and national regulatory framework on AI in Education

This part explores the existing AI regulatory framework at the international, regional and national level, with specific reference to documents aimed at shaping AI regulation in education.

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contrast, the *utility-based approach* is seen as a more flexible solution for specific functions, users' choice, decision-making based on preferences, etc. (SmythOS, 2024).

11 *Text mining* (text analytics) is the process of identifying patterns, extracting quality information and transforming unstructured formats into structured ones. *Computer vision* refers to machine perception/ability to perform visual task (automatic object/images/ movement recognition, video captioning) and audio/speech recognition tasks.
Natural Language Processing (NLP) is the capacity to use natural languages (e.g. English), interact with humans through dialogue (AI assistants), respond to queries (chatbots), process data, generate content (machine translation), etc.
Language Modeling (LM) refers to analyzing patterns of human language to predict words in given context, ensure compliance with morphological, syntax, grammar and semantic rules (grammar/spell-check, text prediction, translation). *Machine learning* (ML) refers to training algorithms to create outputs based on large datasets, text mining, supervised/ unsupervised learning, and reinforcement learning (sequential decision-making).
Deep learning (DL) refers to ML models that mimic the human brain functions by using neural networks and learning algorithms that facilitate computer perception and natural language processing.
Robotics refers to training intelligent machines to manipulate objects, perform tasks and interact with humans by using different forms of machine perception and NLP (e.g. AI robot cleaner).
Internet of Things (IoT) refers to "smart" devices (appliances, vehicles, buildings, cities) which can be interconnected (via wireless networks) to collect and share sensory information for practical purposes.
Crowdsourcing refers to harnessing human intelligence in solving problems that computers cannot solve themselves (e.g. Wikipedia, a large-scale knowledge repository kept and updated by netizens).
AI-based services refer to applications in different sectors: governance, defence, security, healthcare, business, finances, transportation, education, culture, entertainment, etc. (Stanford University, 2016:14-16).

3.1. Regulatory framework on AI at the international level: the UNESCO

The OECD *Principles for responsible stewardship of trustworthy AI* (2019)[12] were the first international principles for policy makers, which were the starting point for development of AI policies at the national level and establishing the global OECD AI Policy Observatory (2020).[13] Yet, in education, the UN Educational, Scientific and Cultural Organization (UNESCO) has significantly contributed to developing the AI regulatory framework at the international level.

The first international document on AI in education was the UNESCO's *Beijing Consensus on AI and Education* (2019),[14] which offered guidance to policy makers on key issues: introduction to AI technologies; recommendations for designing AI policies, management and delivery; promoting equity and inclusion; supporting teaching/learning process and assessment; developing knowledge, values, skills; ensuring transparent, ethical and auditable AI use; fostering research, monitoring and assessment (Miao, Holmes, *et.al.*, 2021:3). It also promoted cooperation in sharing AI policies, guidelines, best practices, resources, tools (UNESCO, 2019:4-10).

The UNESCO's *Recommendation on the Ethics of Artificial Intelligence* (2021)[15] was the first international document that set the global standards (values and principles[16]) for ethical AI use in education, science and culture (UNESCO, 2022:10). In education, states were recommended to: a) *provide adequate education and training for AI literacy, ethics and skills*; b) *raise awareness* about the AI impact on the rule of law and human rights; c) *promote safe, responsible and ethical AI use,* minding the valuable social aspects of traditional education; d)

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12   The OECD *Principles for trustworthy AI* include: 1) sustainable development, inclusion, well-being; 2) human-centered values; 3) transparency; 4) robustness, security, safety; and 5) accountability (OECD, 2019:7-8).

13   The OECD AI Policy Observatory (2020) has a repository of tools for policy implementation, risk monitoring and AI incidents monitoring in the OECD member states (*see*: OECD AI Policy Observatory, 2024).

14   UNESCO (2019). *Beijing Consensus on Artificial Intelligence and Education*: guidance for policy-makers, Paris.

15   UNESCO (2022). *Recommendation on the Ethics of Artificial Intelligence* (23 Nov.2021); UNESCO, Paris, France.

16   The *values* are: a) Respect, protection and promotion of human rights/dignity; b) Sustainable environments (aligned with human, social, cultural, economic, environmental goals); c) Equality, diversity and inclusion; and d) Peace, fairness, justice (UNESCO, 2022:18-20). The *principles* are: 1) Do-no-harm & Proportionality; 2) Safety & Security; 3) Fairness & Non-discrimination; 4) Sustainability; 5) Privacy & Data protection; 6) Transparency & Explainability; 7) Human oversight; 8) Accountability; 9) AI Awareness & Literacy; 10) Collaboration & Governance (UNESCO, 2022:20-23).

monitor and evaluate AI system on their ethical and pedagogical relevance; e) strictly *observe* privacy, data protection requirements, and monitor and assess AI use to prevent abuses; f) *ensure resources* and *inclusion* of minorities/ethnicities, marginalized/vulnerable groups; g) *provide support* and training in ethical research, design, services. use; h) encourage *learning about the benefits, limitations, drawbacks and risks* to enable informed decision-making on AI use for specific purposes (UNESCO, 2022:33-35). To assess states' readiness for AI integration and compliance, there is a practical tool, the UNESCO *Readiness Assessment Methodology* (2023),[17] covering five dimensions: 1) legal and regulatory; 2) social and cultural, 3) economic; 4) scientific and educational; and 5) technological and infrastructural (UNESCO RAM, 2023:3-4). Each dimension is assessed against a list of quantitative and qualitative indicators (UNESCO RAM, 2023:9-24). This tool may be used as a self-assessment tool by educational institutions, but there is also an increasing number of practical online AI-readiness assessment tools covering different aspects of AI integration: strategy, infrastructure, governance, data, expertise/education, culture.[18]

In response to the surging use of Generative AI, the UNESCO's *Guidance for Generative AI in education and research* (2023)[19] focuses on developing policies at the national and institutional level, and strategies for incorporating AI learning opportunities in the curricula, teaching/learning process, research and professional development (UNESCO, 2023:18-27). Notably, this document envisages a responsible, ethical, *human-centric* and *pedagogy-driven* approach to GenAI integration, co-designed (by all stakeholders) and assessed on pedagogical principles: a) relevant domains of knowledge, skills and values; b) relevant GenAI tools and their comparative advantages; c) educational requirements and outcomes; d) effectiveness and user impact; e) ethical considerations and risks; f) requisite pedagogical methods and teacher/student training (AI literacy and competencies) for safe, ethical and purposeful use in teaching/learning, self-paced learning, inquiry/project-based learning, for research and special needs learners (UNESCO, 2023:28-33). It urges for integrating *AI literacy and competencies* in professional development competency frameworks and training programs (UNESCO, 2023:26). In that context, the open-source platform *AI for*

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17   UNESCO RAM (2023). The UNESCO *Readiness Assessment Methodology*: A Tool of the Recommendation on the Ethics of Artificial Intelligence, UNESCO, Paris; https://unesdoc.unesco.org/ark:/48223/pf0000385198.

18   *See*: Cisco (2024). Cisco AI Readiness Assessment; https://www.cisco.com/c/m/en_us/solutions/ai/readiness-index/assessment-tool.html; IBM (2024). AI Journey Assessment ; https://www.ibm.com/analytics/journey-to-ai/assessment/

19   UNESCO (2023). *Guidance for Generative AI in Education and Research*; UNESCO Digital Library, Paris.

Education (2023)[20] provides valuable guidance, resources (articles, webinars, prompt library, lessons) and a free self-paced course for educators. Many technology and education expert have joined forces to assist the AI integration. A good example of such collaboration is *Teach AI Guidance for Schools Toolkit* [21], a practical guide for: a) establishing AI policy framework and guidelines; b) providing structure for teaching/learning; and c) addressing current concern to improve the system and enable digital transformation in education (TeachAI, 2023: 8-9).

To reinforce the ethical, human-centered and pedagogy-driven approach to AI integration in education, the UNESCO experts have developed a new AI competency framework[22], including AI *Competency Framework for Teachers* (2024a)[23] and *AI Competency Framework for Students* (2024b).[24] They exceed the scope of digital competencies and are tailored to address AI challenges and risks, foster AI integration across the curriculum, and encourage interdisciplinary learning, transferable and life-long learning (UNESCO, 2024). For example, *Teachers' AI competency framework* includes 3 competence levels across 5 competency dimensions.[25]

20　AI for Education (2023). An Essential Guide to AI for Educators; https://www.aiforeducation.io/ (accessed 1.10.2014)

21　TeachAI.org (2023). *AI Guidance for Schools Toolkit*, Code, CoSN, Digital Promise, European EdTech Alliance, PACE.
https://docs.google.com/document/d/1OmT-6Nf_B9f8yA6r54QQ-DMSB85njo5JZ6qyR17jFgA/edit?tab=t.o#heading=h.i6tsgfy3sovv

22　UNESCO (2024). UNESCO's new AI competency frameworks for students and teachers, 3 Sept. 2024, https://www.unesco.org/en/articles/what-you-need-know-about-unescos-new-ai-competency-frameworks-students-and-teachers

23　UNESCO (2024a). AI competency framework for teachers, (F.Miao, K.Shiohira), https://doi.org/10.54675/ZJTE2084

24　UNESCO (2024b). AI competency framework for students (F.Miao, M.Chukurova), https://doi.org/10.54675/JKJB9835

25　The 3 competency levels are: basic (acquire knowledge), intermediate (deepen knowledge), advanced (create tailored local solutions: policies, standards, toolkits). The 5 dimensions include:1) *Human-centered mindset:* human agency, accountability, social responsibility; 2. *Ethics of AI:* Ethical principles, safe and responsible use, co-creating ethical rules; 3. *AI foundations*: Basic AI techniques/applications, Application skills, Creating with AI; 4. *AI pedagogy*: AI-assisted teaching, AI-pedagogy integration, AI-enhanced pedagogical transformation; 5. *AI for professional development:* AI-enabled lifelong learning, AI-enhanced organizational learning, AI-supported professional transformation (UNESCO, 2024a:22).

3.2. Regulatory framework on AI in education
at the regional level: the EU, the CoE

The EU embarked on developing the AI framework by adopting the strategic document EU *Artificial Intelligence for Europe* (2018),[26] which envisaged a "*human-centric*" approach where people would be empowered rather than overpowered by AI, which should complement rather than substitute humans (EC/EPSC, 2018:6).[27] The EU AI Strategy envisaged four objectives: 1) provide environment for AI technologies: infrastructure, investments, policies, regulations, data protection; 2) educate AI experts and users; 3) enforce policy to address risks and challenges; and 4) develop ethical and legal frameworks, guidelines, monitor development and impact) (EC/EPSC, 2018:8-12). The EC *Ethics Guidelines on Trustworthy AI* (2019)[28] envisage the key features of AI systems, ethical principles, requirements,[29] and a practical checklist for assessing compliance: *Assessment List for Trustworthy AI (2020).*[30] Consequently, the EC's *Ethical Guidelines on the use of AI and data for educators* (2022)[31] focused on ethical issues, teacher support, competencies, and assessment of AI trustworthiness (EC, 2022: 14-31).[32]

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26 EC/European Commission (2018). *Artificial Intelligence for Europe,* COM/2018/237, Communication from the Commission to the EP, the EC, the European Economic and Social Committee, and the Committee of the Regions, 25.4.2018.

27 EC/EPSC (2018). The Age of Artificial Intelligence: Towards a European Strategy for Human-Centric Machines, *EPSC Strategic Notes (29),* EC European Political Strategy Centre, 27 March 2018; https://data.europa.eu/doi/10.2872/23955.

28 EC/AI HELG (2019). *Ethics Guidelines on Trustworthy AI,* Independent High-Level Expert Group on AI.

29 *A trustworthy AI* system should be *lawful* (compliant with laws), *ethical* (based on ethical principles), and technically *robust (*safe, secure, reliable). It should comply with 4 ethical principles: a) autonomy-choice; 2) harm prevention; 3) equality/fairness; 4) transparency. It should meet 7 key requirements: 1) human rights, agency, supervision; 2) robustness and safety; 3) privacy, data governance; 4) transparency, explicability; 5) diversity, non-discrimination, fairness; 6) societal and environmental welfare; 7) accountability (reports, audits, redress) (EC/AI HLEG, 2019:7-8).

30 *See*: EC/AI HLEG (2020). Assessment List for AI; https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=68342

31 EC (2022). Ethical Guidelines on the use of AI and data in teaching and learning for Educators, Sept.2022, EU,

32 In addition, the EC *Proposal for a AI Liability Directive (2022)* envisaged non-contractual/tort liability and compensation for damage in cases involving AI-based products and services (CyberRisk GmbH, 2024).

The Council of Europe (CoE) attempted to cast more light on the use of AI in education. The CoE's *AI Survey* (2022)[33] identified the major problems: 1) most CoE member states have data policies and AI strategies but lack education-specific policies and ethical guidelines; 2) few states have regulatory framework; 3) there are insufficient research funds, resources, user guides and AI literacy training programs; 4) there is insufficient evidence on AI impact (CoE AI Survey, 2022:1).[34] The subsequent EC/EDEH *AI Report on AI in Education* (2023)[35] provided insights into the needed support (technology, resources, pedagogy), examples of risk-based AI use,[36] and three sets of teachers' competencies: 1) Teaching *about* AI (AI literacy: knowledge, skills, values); 2) Teaching *for* AI (information/data literacy, content creation, collaboration, problem-solving); and 3) Teaching *with* AI, *pedagogy-driven* use (resources, instruction, assessment, learner competencies) (EC/EDEH Report, 2023:9-17). In terms of AI competencies, the EU-supported ARISA project *AI Skills Strategy* (2023)[37] set goals on funding, training, accreditation/certification, collaboration, human-centered curricula/programs, actors' roles, and AI skills for professionals working in specific sectors, policy and decision-makers (ARISA, 2023:2-3). The AI Pioneers project (2023),[38] aimed at developing guidelines for AI integration in adult education and vocational training, aligned *AI competencies* with the Digital Competence framework *(DigCompEdu,* 2017)[39] in six areas: professional

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33   CoE AI Survey (2022).The State of Artificial Intelligence and Education across Europe: a Survey of CoE Member States, COE CDPPE, AI&ED Expert Group. (Survey results covered 25 respondent states out of 46 CoE member states).

34   In order to regulate AI-related issues pertaining to human rights and the rule of law (privacy, data protection, equality/inclusion/non-discrimination, security/safety), the COE adopted the *CoE Framework Convention on Artificial Intelligence and Human Rights, Democracy and the Rule of Law*, CETS 225/2024, https://rm.coe.int/1680afae3c

35   EC/EDEH (2023). AI Report by the European Digital Education Hub's Squad on AI in education, EACEA, 2023.

36   Risks depend on the context: a) *minimal risk* (lesson planning, administrative tasks, formative feedback); b) *limited risk* (teaching/learning, teacher/learner support); c) *high risk* (learning analytics without human scrutiny); and d) *unacceptable risk* (abuse, manipulative practices) (EC/EDEH, 2023:63-73).

37   *See:* ARISA (2023). *AI Skills Strategy for Europe*, Artificial Intelligence Skills Alliance/ ARISA, 30 Sept.2023,
https://aiskills.eu/wp-content/uploads/2024/01/AI-Skills-Strategy-for-Europe.pdf

38   AI Pioneers (2024). Supplement to the DigCompEdu framework (WP3)/Digital Competence for Educator. This, ERASMUS-supported project developed knowledge database and practical tools (*see*: AI Pioneers, 2024).

39   For a summary of the Digital Competence Framework and DigComp for Educators, see: Ignjatović, 2024: 28-29.

engagement, digital resources, teaching/learning, assessment, promoting learners AI skills, and teachers' transferable skills (AI Pioneers, 2024).

In July 2024, the EU Parliament (EP) adopted the *EU Artificial Intelligence Act* (2024),[40] the first legally binding act on the development, deployment and use of AI system, with reference to a proportionate *risk-based approach.*[41] Education and vocational training are classified into *high-risk applications* because AI systems may cause "a significant risk to health, safety and fundamental rights of natural persons' (Art.6 EU AI Act). In the context of education, Annex III of the EUAI Act envisages that high-risk AI systems are used as follows: 1) *AI for admissions* (access and admission to educational/vocational training, including candidate evaluation, ranking); 2) *AI for evaluation* (learning goals and outcomes); c) *AI for assessment* (assess education level, performance, competencies); and d) *AI for proctoring* (monitor conduct and detect prohibited practices in tests/exams, abuse) (FLI, 2024).[42] On further analysis of Article 7§2, we may identify additional high-risk applications: a) automated/autonomous processing of personal data on one's life, preferences, conduct, location, performance, etc.; b) social profiling (based on race, age, gender, social status/circumstances, financial standing); c) privacy violations due to unauthorized/autonomous/AI actions and unclear nature, amount and intended purpose of processed personal data (without an opt-out possibility) or third-party validation; d) lack of authority to control AI and take remedial action to correct or reverse potentially harmful activity; e) AI impact on multiple persons, sensitive groups in particular; f) adverse impact on users physical/mental health (anxiety, AI dependence) and well being, particularly of vulnerable persons). For these reasons, high-risk AI systems must comply with the mandatory requirement, observe assessment procedures, reduce risks, keep use logs, and ensure human

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40 EUR-Lex (2024). *EU Artificial Intelligence Act,* Regulation EU/2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonized rules on artificial intelligence [...], PE/24/2024/REV/1, *OJ EU*, 2024/1689.

41 Under the EU AI Act, AI systems are classified as: a) *Unacceptable Risk AI systems,* which are strictly prohibited as they pose serious threats to human rights, health and safety (biometric identification, emotion/facial recognition, social profiling, deceptive practices); b) *High-Risk AI systems,* which are allowed but subject to additional requirements and assessment (justice, law enforcement, democratic processes, employment/workforce management, educational/vocational training and assessment, etc.); c) *Limited risk AI systems,* which are subject to transparency rules and human supervision (chatbots, AI-generated content, deepfakes); and d) *Minimal risk AI systems,* which may be freely used as they pose minimal or no risk (spam filters, translation, language apps, video games) (FLI, 2024).

42 FLI/Future of Life Institute (2024). Summary of the AI Act, https://artificialintelligenceact.eu/high-level-summary/

scrutiny of transparency, accuracy and effectiveness (AI Act.org, 2024).[43] The EU AI Act sets requirements to be met by all actors involved in developing, providing and using AI systems: 1) establish risk-management systems; 2) devise technical documentation; 3) ensure data governance; 4) ensure automatic record keeping; 5) design user guides; 6) ensure human supervision; 7) ensure robustness, accuracy, cybersecurity; and 8) institute quality management (FLI, 2024).

Based on these international and regional frameworks, many OECD, UN and EU member states[44] have developed national policies, strategies, action plans, and guidelines.[45] Yet, there are still ample concerns about human rights violation, privacy/data protection, non-transparent data training and collection purposes, abusive practices, age-limit,[46] the lack of practical guidelines and approved AI tools tailored for educational purposes (CoE/DGII/EDU/AIED, 2024: 23-24).

3.3. The regulatory framework on AI in education at the national level: Serbia

In line with the EU AI Strategy (2018) and the OECD AI Principles (2019), Serbia adopted the national *AI Development Strategy RS* (2019)[47] for the period 2020-2025 and the Action Plan (2019),[48] which recognized the need to develop relevant infrastructure,[49] provide education about AI, and ensure safe and ethical use of AI technologies. In education, the *AI Strategy* RS (2019) envisaged several goals: define the role of AI in education; provide professional training

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43 AI Act.org (2024). The Artificial Intelligence Act-Reg. (EU) 2024/1689, https://www.artificial-intelligence-act.com/#:)

44 See: OECD AI Policy Observatory (2024). National AI policies (e.g. Australia, Canada, Japan, UK, USA, Serbia).

45 For example, *see*: UK DfE (2023). The UK Department for Education policy paper on Generative AI in Education; UK JSQ (2023). JCQ guidance on AI use in Assessments; University of Cape Town (2024). AI for Teaching and Learning, CILT (Research Guide; Staff Guided on AI Tools, Academic Integrity, Assessment, etc.)

46 The latest GenAIs set age restriction: no access under 18 to Copilot, Gemini, Claude, and no access under 13 to Open AI's ChatGPT and Perplexity, subject to parental consent (CPS, 2024: 18).

47 Government RS (2021). Strategy for the development of AI in the RS for the period 2020-2025, https://www.srbija.gov.rs/extfile/sr/437310/strategy_artificial_intelligence-condensed261219_2.docx

48 *Akcioni plan za period 2020-2022 za primenu Strategije razvoja veštačke inteligencije u RS za period 2020-2025,* (Action plan for the implementation of the AI Strategy RS for the period 202-2025), *Sl. glasnik RS,* br. 96/19.

49 Serbia established the Innovation/Science/Investment Funds [2020], the AI Institute [2021], the AI Platform [2021], and the AI Council [2024] for monitoring AI standards' application (AI Institute 2024; AI Platform, 2024; Forbes[SR], 2024).

for IT experts, informal programs, university cooperation; develop teacher competencies; integrate AI literacy in primary/secondary schools (coding, robotics projects), undergraduate studies (computing, engineering), post-graduate studies (master programs) (AI Strategy RS, 2019:12-13, 24-28). Serbia also adopted the *Ethical Guidelines for the development of Trustworthy AI* (2023),[50] aligned with international/regional standards. In terms of AI competencies, the amended *Digital Competence Framework* (2023)[51] incorporated AI skills at 3 competence levels (basic/intermediate/advanced), across 6 competency domains: digital environment, resources, learner support, teaching/learning, monitoring/assessment, professional engagement (NIQA, 2023:3,10-13).[52] Thus, the cogs have been set in motion, primarily focusing on research, innovation, educating AI professionals and applied AI in the public administration, business, medicine, communications, etc.(AI Institute, 2024).[53] In 2021, technical and science universities offered the first AI master degree programs.[54] In social sciences and humanities, AI use seems to be lagging behind: there is a small number of AI programs[55]; AI literacy courses are unavailable even as informal courses[56]; articles on AI in education are scarce, largely focusing on learning *about* AI rather learning *with* AI;[57] conferences on AI in education have been rare until recently.[58] Despite huge investments, experts note that Serbia still

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50 Vlada RS (2023): *Etičke smernice za razvoj, primenu i upotrebu pouzdane i odgovorne VI* (Ethical Guidelines for the development, deployment and application of trustworthy and responsible AI), *Sl.gl. RS,* br.23/2023.

51 NIQA/National Institute for Quality Assessment (2024), *Okvir digitalnih kompetencija: nastavnik za 21.ve*k (Digital Competences Framework), Zavod za vrednovanje kvaliteta obrazovanja i vaspitanja/ZVKOV, Beograd.

52 For the specification of teacher AI skills, see: NIQA, 2023: 10-13.

53 *See*: AI Institute/ IVI (2024). Projects/Research groups; https://ivi.ac.rs/en/projects/

54 For example, *see:* ELF Niš (2024). Master in AI and ML, Faculty of Electronic Engineering, Niš; FSM Niš (2024). Master in AI and ML, Computing Department, Faculty of Sciences and Mathematics, Niš.

55 E.g.: LF Niš (2024). Master program in Law and ICT (2021), including AI and Legal Reasoning course; LF Novi Sad (2024); Undergraduate program Law and ICT at LF Novi Sad (including AI within the Internet Technologies course).

56 The first free general public course on AI and Prompt Engineering was held by the Digital Serbia Initiative (2024).

57 Brief online search shows the topics covered: a) AI in language learning [2020]; b) AI in education [2021]; c) AI in HE [2022]; d) ChatGPT in ESP; ChatGPT in HE, teacher AI competencies [2024]; for example, see: FTN NS, 2024.

58 PF/Pedagogical Faculty in Vranje (2024). 1st International Scientific Conference *Education and Artificial Intelligence* (EDAI 2024), Pedagogical Faculty in Vranje, University of Niš, 29-30 Nov. 2024.

ranks low in AI integration (Eurostat, 2024),[59] which is due to outdated information systems, inadequate infrastructure, digitization and digitalization, as prerequisites for AI integration. For better results, they note the need for change in the mindset, business culture, a synergy between the academia, science and industries (NIN, 2024).[60]

The legal regulation of AI for educational purposes is sluggish. The Serbian policy makers and administrators have not yet taken full advantage of the presented international and regional regulatory frameworks, standards, guidelines and good practices of AI integration in education. The conducted research has shown that there are no subject-specific legislative and regulatory acts on AI for education. There are no policies, strategies, action plans and guidelines for administrators, institutions, teachers and students. There are no documents on AI competencies. At the institutional level, there are no teacher/student training courses on AI literacy and competencies, nor pedagogical guidance on integrating AI in instructional design, teaching/learning, assessment. The existing AI strategy and ethical guidelines hardly suffice. Educators may only hope that these essential educational issues will be properly addressed in the new AI Strategy (2025-2030), which may provide more latitude for a substantial legislative and regulatory activity of Serbian authorities and involvement of all relevant stakeholders in developing a responsible, human-centered and pedagogy-driven approach to AI integration.

As any other disruptive technology, the use of the latest GenAI in education is still a highly controversial issue in Serbia. There seem to be mixed opinions among the academic, professional and general public about AI application. A study on the general pubic attitudes to AI in Serbia shows that opinions are pretty divided (Budić, 2023).[61] As empirical studies on educators' attitudes are rare, the published abstracts from the recent *Education and Artificial Intelligence*

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59   The Eurostat shows data (for 2023) on the use of AI in several sectors: a) ICT: Serbia 11.6; EU 29.4; Slovenia 32.5; Croatia 40; Finland 48.2%; b) Professional, scientific & technical activities: Serbia 6.5; Croatia 12.9; EU 18.5; Slovenia 22.2; Finland 31.5%; c)Administrative services: Serbia 0.3; Slovenia 3.2; Croatia 6.8; EU 8.3; Finland 14.8%; d) Digital skills: Serbia 33.61; Slovenia 46.7; EU 55.6; Croatia 59; Netherlands 82.7 % (Eurostat, 2024).

60   NIN (2024). Srbija i AI: Na papiru lideri, u praksi pretposlednji (Serbia and AI: Leader in theory, last in practice), 3 jul 2024; https://www.nin.rs/ekonomija/vesti/52273/srbija-ulaze-u-razvoj-vestacke-inteligencije-ali-ne-i-u-njenu-primenu

61   The results (N=737) show the respondents' attitude to AI use (49.39% for, 45.81% against, 3.8% neutral) and concerns: employment loss (49.93% concerned, 26.59 not concerned; 23.47% neutral); trust in AI (41.18% concerned/highly concerned, 28.76% neutral, 10% not concerned); and trust in institutions using AI (70% no trust in Government, 66.4 % no trust in the police; most trust in research/university institutions) (Budić, 2023: 58-59).

conference (EDAI 2024)[62] show this issue has been tackled by several researchers. The author's research on AI in legal education and result of a survey on teachers' attitudes to AI integration (Oct. 2024) will be presented in another article.[63] In future research, it is essential to examine the actual AI use in the educational process, the students' use of AI technologies, and students/teachers' AI use for academic/scientific research purposes which is on the rise due to available GenAI tools.

4. AI in Education: Considerations for Implementation

In light of the aforesaid controversy, this section summarizes the benefits/opportunities and drawbacks/challenges/risks, guiding principles and considerations which have to be carefully considered and balanced in developing viable solutions for AI integration in educational contexts.

The observed *strengths/benefits/opportunities* include: (TeachAI, 2023: 17-22)[64]

1. *Evidence-based and data-driven integration of AI in the curriculum*: a) promoting knowledge on AI technologies, AI literacy, competences; b) improving accessibility, equity, inclusion, quality of education;
2. *Cost-effective learning by using AI technologies*: they facilitate: a) accessible, flexible, adjustable, scalable learning/training aligned with standards; b) time-saving, cost-effective automated/routine tasks;
3. *Automated administrative tasks and operative efficiency*: a) enrolment, curriculum/syllabus design, lesson planning, schedulling, record-keeping, attendance, grading; b) monitoring, tracking progress, evaluation;
4. *Personalized and differentiated learning:* a) adaptive learning tailored to individual needs, preferences, skills, proficiency level, pace; b) assistance through data-driven insights, access to tutoring and support;
5. *Learning by design: human-centered* approach: a) tailored to specific educational standards, requirements, goals, career paths; b) customized pedagogy (collaboration, methodology, assessment, learning analytics);

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62 *See:* PF Vranje (2024). Education and Artificial Intelligence –Book of Abstracts, EDAI 2024, Pedagogical Faculty Vranje, Uni. Niš (see: pp. 20, 23, 28,36,39); https://www.pfvr.ni.ac.rs/wp-content/uploads/2024/11/Book-of-Abstracts-2024.pdf

63 The survey results on LF Nis teachers' attitudes to AI use in legal education are currently prepared for publication.

64 TeachAI (2023). AI Guidance for Schools Toolkit, Code, CoSN, Digital Promise, European EdTech Alliance, PACE.

6. *Content development and differentiation:* AI-generated resources, lesson plans, engaging content,; customized and differentiated tasks, activities, quizzes, assessment/feedback tools; interaction;

7. *Assessment design, analysis and feedback:* ethical considerations in automated summative assessment (tests, quizzes, grading, attendance), formative assessment, informal feedback; efficiency analysis and audit;

8. *Creativity, collaboration, and skill development:* human agency, choice, collaboration, critical thinking, creativity, transferable/life skills; co-design of informed, responsible creators/users; (UniCanadaWest, 2024);[65]

9. *Immersive learning:* hands-on activities via AI-powered devices, virtual reality (VR), augmented reality (AR) and mixed reality (XR) tools for gamification, simulated real-world scenarios, increased engagement;

10. *Complementary role:* AI should not replace teachers but support teaching/learning, training/development; human control, assessment and efficiency audits are vital (PowerSchool, 2024;[66] Digiexam, 2024).[67]

The *drawbacks/challenges/risk* of using AI in education include: (TeachAI, 2023: 17-22)

1. *Overreliance and dependence on AI*: it may diminish creativity, critical thinking, problems-solving skills; it may be harmful for human mind and disruptive in case of technical failures (UniCanadaWest, 2024);

2. *Lack of human interaction:* dehumanized learning void of human interaction, emotional support, empathy has adverse impact on social skills, affection, and pedagogical values (engagement, collaboration, critical thinking);

3. *Data privacy, data protection and security:* unauthorized data collection (records, learning analytics), inadequate data protection, monitoring and surveillance safeguards may compromise privacy (Digiexam, 2024);

4. *Plagiarism and academic dishonesty*: lack of tools and competences to preclude risks may lead to abuse of academic integrity, cheating, manipulative practices that undermine fair assessment (UniCanadaWest, 2024);

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65 University Canada West (2024). Advantages and Disadvantages of AI in Education (B. Clugston), 19 July 2024.

66 PowerSchool (2024). The Ultimate Guide to AI in Education: Benefits, challenges & real-world uses, 29 Oct. 2024.

67 Digiexam (2024). Advantages and Disadvantages of AI in Education (N.Vernersson), 2024

5. *Propensity to bias and hallucinations*: AI-generated data may be biased, inaccurate, false, nonsensical and even non-existent (*hallucinations*), resulting in misconceptions (UniCanadaWest, 2024; Digiexam, 2024);

6. *Diminished teacher/student agency and accountability*: overreliance and unethical use of AI undermine teacher/learner agency (voice, choice, autonomy) and diminish inclusion, collaboration, accountability);

7. *Teacher redundancy and job displacement:* AI benefits raise concerns about teacher redundancy, devaluation of the teaching profession, job loss (UniCanadaWest, 2024), and role in the new learning paradigm;

8. *Disparities and inequalities:* lack of investment, resources, unequal/limited access to resources, non-inclusion, lack of training on AI literacy/skills deepen the digital divide and obstruct integration;

9. *Inadequate regulatory framework:* there is a lack of comprehensive, flexible and future-oriented regulation, data governance, privacy and security safeguards, quality assurance, audits (PowerSchool, 2024).

10. *Human mindset:* fear of the unknown, lack of interest, understanding, competencies, beliefs in traditional education, and reluctance/resistance to change lead to rejecting the integration of AI technologies in education.

In addition to the general *ethical principles* for AI integration, educational experts have identified *7 guiding principles for AI integration* in educational contexts (TeachAI, 2023: 10-27):

1. *Purpose:* purposeful, ethical and responsible AI use aligned with educational goals, promoting research, professional development, staff/student training, interdisciplinary projects, etc.;

2. *Knowledge:* promote AI literacy and competencies (knowledge, skills, values, aptitudes) for critical use;

3. *Compliance:* adherence to the existing normative framework (human rights, data protection, security), ethical, administrative and pedagogical considerations in handling sensitive data;

4. *Human agency:* promote human agency, intervention and scrutiny of AI decision-making;

5. *Academic Integrity:* promote academic honesty (respect, fairness, critical valuation, responsibility), set clear academic standards on proper use to avoid plagiarism and abuse;

6. *Assessment:* assess AI impact (via surveys, feedback, reports, tech support, monitoring, internal/external audits); adjust summative/formative/informal assessment in the teaching/learning process;

7.   *Balance:* raise awareness of benefits, purpose, opportunities and address risks to preclude harm, bias, abuse.

Experts also identified several stages in the *process of integrating a relevant AI framework* in education: 1) secure investment in AI infrastructure and technology (Powerschool, 2024); 2) create evidence-based policies and guidance; 3) provide AI literacy and competences training (administrative staff, teachers, students); 4) integrate AI in curricula/syllabi, lesson planning, teaching methods; 5) provide structure for management, instruction, inclusion, assessment, quality control; 6) address concerns and risks, monitor and assess AI effectiveness, make adjustments to improve experiences and outcomes (TeachAI, 2023:8; Digiexam, 2024).

After the initial expert concerns about the potential existential threat to humans from superintelligent machines[68] and warnings to beware of the GenAI *"black-box algorithm"*[69], some experts recently called for a moratorium on training AI systems "more powerful than GPT-4", which are largely unregulated and uncontrollable even by their creators (FLI, 2023).[70] They noted that GenAI systems "must be more accurate, safe, interpretable, transparent, robust, trustworthy and loyal"; they should be in the service of humanity rather than tech companies; their development and deployment must be planned and managed with utmost care, and they may be used only when humans are sure about their "positive effects and manageable risks" (FLI, 2023). Nothing has changed since. Intelligent machines keep evolving and humans keep using them for different purposes, but GenAI technologies are still beyond effective control.

5. Conclusions and considerations

The presented research results demonstrate considerable efforts exerted by the competent international organizations (OECD, UNESCO) and regional institutions (at the EU and the CoE level) to map the AI-related issues and adopt relevant strategic and policy documents on AI in general and AI in education in particular. While most documents adopted in the field of education (recommendations, guidelines for policy makers and educators, practical user

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68   The British scientist S. Hawking and tech giants (B. Gates, E.Musk) warned about this threat in 2014-2015. *See*: Guardian (2015). Artificial Intelligence: a strong concern, S.Dredge, 29.Jan. 2015).

69   The hidden *black box algorithm is* not publically available because it is treated as company intellectual property, or it may be publically available but extremely complex, unintelligible and confusing to policy makers in decision-making processes; s*ee*: Financial Times (2022).Beware the rise of the black box algorithm (S. Bush), 20 Sept. 2022.

70   FLI/Future of Life Institute (2023). Pause Giant AI Experiments: An Open Letter, 22 March 2023, https://futureoflife.org/open-letter/pause-giant-ai-experiments/ (accessed on 15.11.2024).

guides) are not legally binding, they are valuable sources for policy makers and educational institutions at the national level in the process of instituting adequate regulatory frameworks for AI integration in specific educational contexts. At the national level, the AI Strategy (2019) was the stepping stone for developing infrastructure, human resources and ethical standards for safe AI use. However, Serbia still has not adopted a general legislative act on AI, which precludes the enactment of sector-specific regulatory acts on AI use in different areas of life, including education. The research results show that the use of AI in education is still largely unregulated in Serbia. There are no AI policies, action plans, guidelines; there are no AI competence frameworks for teachers and students, there are no AI literacy and skills training courses, nor pedagogical guidelines for AI integration in the instructional design. These issues may be addressed in the new AI strategy (2025-2030) but the regulation keeps lagging behind the rapid development of AI technologies.

Meanwhile, educators cannot ignore new GenAI technologies, which are increasingly used in different educational contexts. Although AI use cannot be forced either on institutions or individuals, educators have to prepare for the ensuing change in the teaching/learning paradigm. In order to keep pace, they need to learn how AI technologies may be used in a safe, reliable and ethical manner. To make informed decisions on whether and to what extent AI tools may be incorporated in the educational process, they need to understand the benefits and drawbacks, challenges and risks, available options and approaches to using AI in education. While it is indisputable that AI tools can enhance interactive learning and support instruction for different academic, scientific and professional purposes, there are new disruptive GenAI technologies which generate numerous concern and risks, identified in theory and practice alike. Different stakeholders may have different perceptions and priorities but, essentially, it is vital to balance the advantages and disadvantages when considering the integration of AI in educational contexts and preparing learners for new forms of learning and real-life applications.

The multidimensional process of integrating a *relevant* AI framework in the specific educational context has to address many technical, social, cultural and educational issues. It certainly entails an interdisciplinary approach, partnership and coordinated action of competent authorities, institutions and other stakeholders. In the process, it is essential to: 1) raise awareness about the purposeful AI integration; 2) assess specific needs and provide regulatory framework for proper AI applications at the national, institutional and subject-specific levels; 3) invest in infrastructure, resources, tech support, AI literacy and competences training; 4) design guidelines for integration, instruction, quality assurance, human supervision; 5) monitor and assess risks, effectiveness and remedial measures; and 6) remain vigilant and responsive to challenges.

There is no dispute that AI has the capacity to transform education but the actual trajectory will be set by educational institutions and stakeholders, whose actions and decisions will determine whether the transformation is positive and sustainable or negative and detrimental for education.

As any disruptive technology, AI may overwhelm, frustrate and dishearten possible users. AI technologies should empower rather than overpower users. In the field of education, it is essential to strike the right balance in terms of ensuring a *holistic*, *human-centered* and *pedagogy-driven* integration within the framework of *blended (hybrid) learning*, based on the key assets: safe technology, human agency, constant support/training, collaboration, stringent assessment and supervision. While all stakeholders shall be active co-agents in instructional design, students and teachers' agency, competencies and wellbeing shall remain the focal point of the new learning paradigm. If purposefully and critically used, AI tools can promote learning but teachers shall remain the critical human resource, capable of facilitating the rudimentary social, affective, psychological and pedagogical aspects of education which cannot be provided by intelligent machines: the human touch, interactions, socialization, psychological and pedagogical insights, as well as human scrutiny of AI technologies and supervision of the entire educational process.

References

Kok, J.N., Boers E.J.W, Kosters W.A, van der Putten P, Poel M. (2009). Artificial Intelligence: Definition, Trends, Techniques and Cases (Chapter 1), in: *Artificial Intelligence* (J.N.Kok (ed.), *Encyclopedia of Life Support Systems,* vol.1, UNESCO- EOLSS, 2009, p.2, https://www.eolss.net/sample-chapters/c15/e6-44.pdf

Miao, F., Holmes W., Huang R., Zhang H. (2021). AI and Education: Guidance for policy-makers, UNESCO, Paris; https://unesdoc.unesco.org/ark:/48223/pf0000376709?posInSet=1&queryId=f7246403-9770-49a8-8741-4c539c8784f8

Rao A. S., Verweij G. (2017). Sizing the prize, PwC network, Price Waterhouse Coopers Int. Ltd, UK, 2017; https://www.pwc.com/it/it/publications/assets/docs/PwC_AI-analysis_report.pdf

Samoili, S, López Cobo M, Gómez E, De Prato G, Martínez-Plumed F, Delipetrev B. (2020). *AI Watch: Defining Artificial Intelligence.* Towards an operational definition and taxonomy of AI EC Joint Research Center, Luxembourg, https://publications.jrc.ec.europa.eu/repository/bitstream/JRC118163/jrc118163_ai_watch._defining_artificial_intelligence_1.pdf

Stanford University (2016). Artificial Intelligence and Life in 2030, 100 Year Study on Artificial Intelligence, Report, Appendix I: A Short History of AI, 2016; https://ai100.stanford.edu/2016-report/appendix-i-short-history-ai#:, https://

ai10020201023.sites.stanford.edu/sites/g/files/sbiybj18871/files/media/file/ai100re-port10032016fnl_singles.pdf (19.10.2024)

TeachAI.org (2023). AI Guidance for Schools Toolkit, Code, CoSN, Digital Promise, European EdTech Alliance, PACE; https://docs.google.com/document/d/1OmT-6Nf_B9f8yA6r54QQ-DMSB85nj05JZ6qyR17jFgA/edit?tab=t.0; https://www.teachai.org/toolkit;

Budić, M. (2023) Etičke dileme i stavovi prema primeni veštačke inteligencije (Ethical dilemas and attitudes to AI), *Kritika:* časopis za filozofiju i teoriju društva, 1/2023 (49-65); https://kritika.ifdt.bg.ac.rs/index.php/kc/article/view/124/218

Ignjatović, G. (2024). Digital Learning in Legal Education: Educational policies, practices, and potentials of pedagogy-driven digital integration, in: *Facta Universitatis Series: Law and Politics*, Vol.22, No.1, 2024, pp.25-46, University of Niš, Serbia; https://doi.org/10.22190/FULP240305003I

International documents and sources (OECD, UNESCO)

OECD (2017). Science, Technology and Industry Scoreboard 2017: The Digital Transformation, OECD; https://www.oecd.org/content/dam/oecd/en/publications/reports/2017/11/oecd-science-technology-and-industry-scorebo-ard-2017_g1g74dc7/9789264268821-en.pdf (accessed 8.10.2024)

OECD (2019). Recommendation of the Council on Artificial Intelligence, OECD Legal instruments, OECD/LEGAL/0449, Paris (amended 2024), https://oecd.ai/en/assets/files/OECD-LEGAL-0449-en.pdf;

OECD AI Policy Observatory (2024), National AI policies & strategies (https://oecd.ai/en/dashboards/overview); AI Principles overview (https://oecd.ai/en/ai-principles; https://oecd.ai/en/catalogue/overview; https://oecd.ai/en/incidents);

UNESCO (2019), Beijing Consensus on Artificial Intelligence and Education: guidance for policy-makers, UN Educational, Scientific and Cultural Organization, Paris, France; https://unesdoc.unesco.org/ark:/48223/pf0000368303

UNESCO (2022). Recommendation on the Ethics of Artificial Intelligence (23.Nov 2021); UNESCO Digital Library, https://unesdoc.unesco.org/ark:/48223/pf0000381137?posInSet=3&queryId=2a46fb66-02c5-466a-ba78-896309ae8c54

UNESCO (2023). Guidance for Generative AI in Education and Research, https://unesdoc.unesco.org/ark:/48223/pf0000386693

UNESCO RAM (2023). The UNESCO Readiness Assessment Methodology: A Tool of the Recommendation on the Ethics of Artificial Intelligence, UNESCO, Paris; https://unesdoc.unesco.org/ark:/48223/pf0000385198

UNESCO (2024). UNESCO's new AI competency frameworks for students and teachers, 3 Sept. 2024, https://www.unesco.org/en/articles/what-you-need-know-about-unescos-new-ai-competency-frameworks-students-and-teachers

UNESCO (2024a). AI competency framework for teachers, (F.Miao, K.Shiohira), https://doi.org/10.54675/ZJTE2084

UNESCO (2024b). AI competency framework for students (F.Miao, M.Chukurova), https://doi.org/10.54675/JKJB9835

AI for Education (2023). An Essential Guide to AI for Educators; https://www.aiforeducation.io/; https://www.aiforeducation.io/ai-resources-main; https://www.aiforeducation.io/ai-course (accessed 1.10.2014)

Regional documents and sources (CoE, EU)

CoE AI Survey (2022).The State of Artificial Intelligence and Education across Europe: Survey of CoE member states, AI&ED Expert Group, COE Committee for Education Policy and Practice; https://rm.coe.int/ai-coe-survey-report-latest-2753-8190-7209-v-1/1680aec34c

CoE/DGII/EDU/AIED (2024) Preparatory study for the development of a legal instrument on regulating the use of AI systems in education (draft), 6 March 2024, CoE Directorate General of Democracy and Human Dignity Directorate for Democracy, Education Department Digital Transformation Unit, CoE, Strasbourg; https://rm.coe.int/preparatory-study-for-the-development-of-a-legal-instrument-on-regulat/1680af118c

CoE/Council of Europe (2024). *CoE Framework Convention on Artificial Intelligence and Human Rights, Democracy and the Rule of Law*, Vilnius, 5.9.2024, CETS 225/2024, Strasbourg; https://rm.coe.int/1680afae3c

EC/European Commission (2018). *Artificial Intelligence For Europe*, COM/2018/237, Communication from the Commission to the EP, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions, Brussels, 25.4.2018; https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018DC0237

EC/EPSC (2018). The Age of Artificial Intelligence: Towards a European Strategy for Human-Centric Machines, European Political Strategy Centre, EU27 March 2018; https://op.europa.eu/en/publication-detail/-/publication/f22f6811-1007-11ea-8c1f-01aa75ed71a1/language-; https://data.europa.eu/doi/10.2872/23955

EC/AI HELG (2019). *Ethics Guidelines on Trustworthy AI,* Independent High-Level Expert Group on Artificial Intelligence, European Commission, 8 April 2019, Brussels; updated 2023; (accessed 20.10. 2024) https://www.europarl.europa.eu/cmsdata/196377/AI%20HLEG_Ethics%20Guidelines%20for%20Trustworthy%20AI.pdf

EC/AI HLEG (2020). *Assessment List for Trustworthy AI* (ALTAI), Independent High-Level Expert Group on AI, European Commission, Brussels; https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=68342

EC/European Commission (2022). *Ethical Guidelines on the use of AI and data in teaching/learning for Educators*, Luxembourg; https://op.europa.eu/en/publication-detail/-/publication/d81a0d54-5348-11ed-92ed-01aa75ed71a1/language-en

EC/EDEH (2023). AI Report by the European Digital Education Hub's Squad on AI in education, EDEH, ECEA, 2023; https://op.europa.eu/en/publication-detail/-/publication/9bb60fb1-b42a-11ee-b164-01aa75ed71a1/language-en

EUR-Lex (2024). *EU Artificial Intelligence Act,* Regulation EU/2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on AI (Artificial Intelligence Act), and amending Regulations EC/300/2008, EU/167/2013, EU/168/2013, EU/2018/858, EU/2018/1139 and EU/2019/2144 and Directives 2014/90/EU, EU/2016/797, EU/2020/1828, *Official Journal EU*, 2024/1689, 12.7.2024; https://eur-lex.europa.eu/eli/reg/2024/1689/oj

AI Act.org (2024). The Artificial Intelligence Act- Regulation (EU) 2024/1689, https://www.artificial-intelligence-act.com/#: (accessed 15.12.2024)

AI Pioneers (2024). Supplement to the DigCompEDU framework (WP3)/Digital Competence for Educators. https://aipioneers.org/supplement-to-the-digcompedu-framework; https://aipioneers.org/knowledge-base (accessed 14.11.2024)

ARISA (2023). *AI Skills Strategy for Europe*, Artificial Intelligence Skills Alliance/ARISA, 30 Sept.2023; https://aiskills.eu/wp-content/uploads/2024/01/AI-Skills-Strategy-for-Europe.pdf; (accessed 14.11.2024)

Cyber Risk GmmbH (2024). The Artificial Intelligence Liability Directive; https://www.ai-liability-directive.com/

FLI/ Future of Life Institute (2024). High-level summary of the EU AI Act, Future of Life Institute, 27 Feb. 2024; https://artificialintelligenceact.eu/high-level-summary/(accessed 25.11.2024)

Serbian documents and sources

Government RS (2021). Strategy for the development of AI in the Republic of Serbia for the period 2020-2025 *(Strategija razvoja veštačke inteligencije u Republici Srbiji za period 2020–2025, Službeni glasnik RS,* br. 96/19); https://www.srbija.gov.rs/extfile/sr/437310/strategy_artificial_intelligence-condensed261219_2.docx

Vlada RS (2021). *Akcioni plan za period 2020-2022 za primenu Strategije razvoja veštačke inteligencije u RS za period 2020-2025* (Action plan for the implementation of the AI Strategy RS for the period 202-2025), *Službeni glasnik RS,* br. 96/19; https://pravno-informacioni-sistem.rs/eli/rep/sgrs/vlada/drugiakt/2020/81/1/reg

Zaključak Vlade RS (2023). *Etičke smernice za razvoj, primenu i upotrebu pouzdane i odgovorne veštačke inteligencije* (Ethical Guidelines for the

development, deployment and application of trutworthy and responsible AI), *Službeni glasnik RS,* br.23/2023; http://demo.paragraf.rs/demo/combined/Old/t/t2023_03/SG_023_2023_007.htm

NIQA/National Institute for Quality Assessment (2024). *Okvir digitalnih kompetencija: nastavnik za 21.ve*k (Digital Competences Framework), Zavod za vrednovanje kvaliteta obrazovanja i vaspitanja, Beograd, https://ceo.edu.rs/wp-content/uploads/2024/02/2024_ODK_Nastavnik-za-digitalno-doba-2023-1.pdf

Forbes Serbia (2024). Vlada Srbije obrazuje savet sa veštačku intelingenciju (Serbian Government establishes the AI Council, 25 jul 2024, https://forbes.n1info.rs/vesti/vlada-srbije-obrazuje-savet-za-vestacku-inteligenciju/

NIN (2024). Srbija i AI: Na papiru lideri, u praksi pretposlednji (Serbia and AI: Leaders in theory, last in practice), 3 jul 2024; M. Jovanovic, https://www.nin.rs/ekonomija/vesti/52273/srbija-ulaze-u-razvoj-vestacke-inteligencije-ali-ne-i-u-njenu-primenu

AI Institute RS/IVI (2024). About the AI Research & Development Institute, IVI/Institut za veštačku inteligenciju, Srbija, https://ivi.ac.rs/en/about-us/; https://ivi.ac.rs/en/projects/ ; https://ivi.ac.rs/en/news/

AI Platform RS (2024). AI Platform, Government RS; https://www.ai.gov.rs/tekst/en/95/national-ai-platform.php; AI in Master Studies; https://www.ai.gov.rs/tekst/en/107/ai-in-master-studies.php

Online sources

Digiexam (2024). Advantages and Disadvantages of AI in Education (N.Vernersson), (accessed 25.11.2024) https://www.digiexam.com/blog/advantages-and-disadvantages-of-artificial-intelligence-in-education

PowerSchool (2024). The Ultimate Guide to AI in Education: Benefits, challenges & real-world uses, 29 Oct. 2024, https://www.powerschool.com/blog/ai-in-education/ accessed 25.11.2024

University Canada West (2024). Advantages and Disadvantages of AI in Education (B. Clugston), 19 July 2024; https://www.ucanwest.ca/blog/education-careers-tips/advantages-and-disadvantages-of-ai-in-education/, accessed 20.11.2024

Eurostat (2024). Artificial intelligence by NACE Rev.2 activity: Statistical classification of economic activities in the EC, 2023 (update 24.9.2024): https://ec.europa.eu/eurostat/databrowser/view/isoc_eb_ain2/default/bar?lang=en ; https://ec.europa.eu/eurostat/databrowser/view/eq_dsklo8/default/bar?lang=en&category=eq.eq_educ.eq_dskl, accessed 28.11.2024

Cisco (2024). AI Readiness Assessment; https://www.cisco.com/c/m/en_us/solutions/ai/readiness-index/assessment-tool.html

CPS/Chicago Public Schools (2023). AI Guidebook; https://www.cps.edu/globalassets/cps-pages/initiatives/ai-guidebook/cps-ai-guidebook-2024.pdf

Financial Times (2022).Beware the rise of the black box algorithm (S. Bush), 20 Sept. 2022; (accessed 25.11.2024) https://www.ft.com/content/3d5556c5-520e-497a-aa5e-2546c5bc50cf

FLI /Future of Life Institute (2023). Pause Giant AI Experiments: An Open Letter (22 March 2023); https://futureoflife.org/open-letter/pause-giant-ai-experiments/

Guardian (2015). Artificial Intelligence: a strong concern (S. Dredge), 29 Jan. 2015; (accessed 15.11.2024) https://www.theguardian.com/technology/2015/jan/29/artificial-intelligence-strong-concern-bill-gates

IBM (2024). What is artificial intelligence (AI)? (16 August 2024); https://www.ibm.com/topics/artificial-intelligence

IBM (2023) Understanding the different types of artificial intelligence, IBM Data and AI Team, 12 Oct. 2023; https://www.ibm.com/think/topics/artificial-intelligence-types

ISO (2024) What is artificial intelligence (AI)? International Organization for Standardization (online), https://www.iso.org/artificial-intelligence/what-is-ai (accessed 8. 10. 2024

OED/Oxford English Dictionary (2023). Artificial Intelligence, In: *Oxford English Dictionary* (online) https://www.oed.com/dictionary/artificial-intelligence_n?tab=meaning_and_use#38531565 (accessed 10.10. 2024)

PF Pedagogical Faculty Vranje (2024). Education and Artificial Intelligence – Book of Abstracts, 1st International Scientific Conference *Education and Artificial Intelligence* (EDAI 2024), Pedagogical Faculty in Vranje, University of Niš, 29-30 Nov. 2024; https://www.pfvr.ni.ac.rs/wp-content/uploads/2024/11/Book-of-Abstracts-2024.pdf; https://www.pfvr.ni.ac.rs/wp-content/uploads/2024/11/EDAI-2024-Conference-Program_final1.pdf

SmythOS (2024). Understanding Utility-Based AI Agents and their Applications. (A. de Ridder), 31.Oct.2024); https://smythos.com/ai-applications/process-automation/utility-based-ai-agents/

TechTarget (2024). The History of Artificial Intelligence: Timeline, (R. Karijian), 24 Sept. 2024; https://www.techtarget.com/searchenterpriseai/tip/The-history-of-artificial-intelligence-Complete-AI-timeline.

UK DfE/UK Department for Education (2023). Policy Paper: Generative AI in Education, UK Department for Education, 29 March 2023; https://www.gov.uk/government/publications/generative-artificial-intelligence-in-education/generative-artificial-intelligence-ai-in-education

UK JCQ/Joint Council for Qualifications (2023). Artificial Intelligence Use in Assessments: Protecting the Integrity of Qualifications, Guidance for Teachers & Assessors, 26 April 2023; https://www.jcq.org.uk/wp-content/uploads/2024/07/AI-Use-in-Assessments_Feb24_v6.pdf

University of Cape Town (2024). AI for Teaching and Learning, Center for Innovation in Learning &Teaching/CILT, Uni Cape Town, https://cilt.uct.ac.za/teaching-resources/artificial-intelligence-teaching-learning

Digital Serbia Initiative (2024). *Kurs veštačke inteligencije i prompt inženjeringa* (AI and Prompt Engineering, 19.6. 2024, https://www.dsi.rs/osnazite-svoje-digitalne-vestine-predstavili-smo-kurs-vestacke-inteligencije-i-prompt-inzenjeringa/

Fakultet tehničkih nauka NS (2024): *Zbornik radova: Nastavnici i saradnici kao centar promena u visokom obrazovanju* (Teaching Staff as the center of change in higher education), FTN, Univerzitet u Novom Sadu, Feb. 2024; http://www.trend.uns.ac.rs/stskup/trend_2024/TREND2024-ZBORNIK-RADOVA.pdf

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VEŠTAČKA INTELIGENCIJA U OBRAZOVANJU: REGULATORNI OKVIRI NA MEĐUNARODNOM, REGIONALNOM I NACIONALNOM NIVOU

Rezime

Veštačka inteligencija (Artificial Intelligence) ima predispozicije da transformiše obrazovanje i oblikuje novu paradigmu učenja. Multidimenzionalni proces integracije veštačke inteligencije (VI) u oblast obrazovanja obuhvata sagledavanje raznih tehnološko-razvojnih, ekonomskih, pravnih, socijalnih i pedagoških izazova. Ovaj rad prikazuje rezultate istraživanja o veštačkoj inteligenciji u obrazovanju, sa fokusom na dokumentima usvojenim na međunarodnom, regionalnom i nacionalnom nivou. Relevantne međunarodne, regionalne i nacionalne institucije nastojale su da mapiraju njen konceptualni okvir, tipologiju i ključnu tematiku kako bi kreirale okvir za njeno regulisanje i odgovornu primenu. U oblasti obrazovanja, međunarodne i regionalne institucije usvojile su dokumente koji mogu biti korisni prilikom kreiranja nacionalnih politika, propisa i smernica za upotrebu veštačke inteligencije u obrazovanju. U tom kontekstu, prvi deo rada predstavlja konceptualni okvir veštačke inteligencije (VI) i ključne pojmove povezane sa VI tehnologijom. Drugi deo rada daje pregled regulativnih okvira kojima se ova tematika uređuje na međunarodnom nivou (OECD, UNESCO), regionalnom nivou (EU, CoE) i nacionalnom nivou (Srbija), sa posebnim osvrtom na dokumenate kojima se uređuje upotreba veštačke inteligencije u oblasti obrazovanja. U trećem delu se sumiraju ključne prednosti i mogućnosti, nedostaci i rizici upotrebe VI u obrazovanju, i razmatraju faktori koje treba uzeti u obzir prilikom odlučivanja o adekvatnom obliku integracije VI u obrazovni proces. U završnim napomenama, uz sumiranje ključnih nalaza, ukazuje se na važnost uravnotežene i odgovorne primene VI tehnologija u obrazovanju, u skladu sa najvišim etičkim principima, pedagoškim standardima i garancijama zaštite ljudskih prava. Pažljivo osmišljeni regulatorni okvir, odgovarajuća infrastrukura, resursi, konstantna podrška, smernice, kao i praktična obuka svih aktera radi sticanja adekvatnih kompetencija su nužne u kontekstu promovisanja transparentne, odgovorne i sigurne upotrebe veštačke inteligencije u oblasti obrazovanja.

***Ključne reči**: veštačka inteligencija (VI), VI tehnologije, regulatorni okvir, etički principi, obrazovanje.*