

## Ethical Use of Artificial Intelligence and New Technologies in Education 5.0

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### ABSTRACT

AI-powered tools such as text-generating algorithms, automatic essay graders, and plagiarism detection software are some of the tools that may be used by the students for improving their skills. For Primary and Secondary Education students, Artificial Intelligence (AI) tools offer a variety of ideas, essay outlines and answers to questions. Generally, students can use AI tools appropriately to improve their learning experience. However, AI tools can be used by students for cheating on assignments and/or exams. It is crucial for a professor or a school generally, to educate students on the ethical use of AI-powered tools and emphasize the importance of academic integrity to prevent cheating. The purpose of this paper is to examine and propose some AI-powered tools that could be used by professors for enhancing students' interaction and engagement. Moreover, the ethical issues for using AI and New Technologies in Primary and Secondary Education will be described using the examples of the proposed AI-tools. Finally, some recommendations and scenarios for responsible use of AI will be suggested in order to be used by policy makers and schools. The findings will be practical and significant, as not enough attention has been paid in Ethical use of AI in Primary and Secondary education.

**Keywords:** Ethics; Artificial intelligence; Primary education; Secondary education

### 1. Introduction

Last years, the fastest development of personal computers and information systems has transformed the traditional primary and secondary education into a fully or hybrid digital education (Education 5.0). This was reinforced during the Covid-19 period, where all the students participated in classes through collaboration systems (MS Teams, Zoom, Skype etc.). Students daily use various systems like eLearning platforms, plagiarism detection systems, e-encyclopedias, word/presentations/worksheets processing systems, AI Powered Tools etc. for preparing their homework and assignments.

Artificial Intelligence (AI) is a discipline of Computer Science that involves the creation of intelligent machines after providing them with algorithms and directions, for performing specific tasks such as decision-making, data analytics, learning, and problem-solving. AI requires human intelligence which

plays a crucial role in the evolution and development of this field. It has evolved over several decades thanks to the contributions of researchers and developers. It could also have a wide range of positive implications for society and the economy in general. Some of the positive consequences include increased efficiency, enhanced way of working, reduced errors, increased production and profitability, and enhanced citizen services and product development.

The advent of AI in human's lives by using some natural language processing tools like ChatGPT, Bard, Bing AI and more, has affected education too. Artificial intelligence has been widely applied in educational practices (Artificial Intelligence in Education; AIEd), such as intelligent tutoring systems, teaching robots, learning analytics dashboards, adaptive learning systems, human-computer interactions, etc<sup>8</sup>. Different AI methodologies (natural language processing, neural networks, machine learning, deep learning, big data analytics and genetic

algorithms) have been implemented to create smart learning environments for behavior detection, prediction model building, learning recommendation, etc.<sup>8,26</sup>.

As technology and society are constantly evolving, it is evident that there is a need to redefine ethics based on the new digital ecosystem. Morality is a product of evolutionary history; in other words, a dimension of morality is adaptation. In this context, referring to digital ethics, researchers essentially focus on the way of applying and adapting ethics to the new digital environments. Specifically, Digital Ethics deals with the impact of the integration of Information and Communication Technologies (ICT) on our societies and the environment in general. It focuses on a range of issues and concerns such as:

- Artificial Intelligence (AI) and algorithmic decision making, including fairness.
- The automation of human intelligence for robotics or autonomous vehicles
- Artificial intelligence and the future of work and governance.
- The use of intelligent technologies in healthcare and medicine

Algorithmic decision making raises a number of questions:

- i. Who is responsible when human rights are violated based on algorithmic decision, the person who programmed the algorithm, the operator of the algorithm, or the human who implemented the decision?

- ii. What is the difference between such a decision and a human decision?

At the same time, researchers emphasize the critical role of private and public education for enhancing critical thinking skills and promoting an ethical culture and use of technology. The paper is organized as follows: the second section presents the use of AI in education; AIED and some AI-powered tools for enhancing students’ interaction and engagement. Based on the proposed tools, all the Ethical Issues of AI and New Technologies are presented in the third section and various scenarios for responsible use of ethical AI in Primary and Secondary Education are proposed in the fourth section. Finally, in the last section, the conclusions are presented.

## 2. Related Work

Based on research done in accordance with the advantages of using AI technologies in primary and secondary education and the Ethical Use of AI in these two levels of education, we concluded that very limited research work has been published so far concerning not only the benefits of AI in K-12 education but also in AI ethics. We ended up in the presentation of two tables. **(Table 1)** shows some related articles which referred to the advantages of AI in primary and secondary education, whereas **(Table 2)** shows some recent articles which concern the Ethical use of AI in the examined levels. In each of the tables, the first column designates the title of the corresponding article, the second column designates the examined topics, the third column specifies the examined level of education and the last column the citation and the year of publication.

**Table 1:** Articles for the advantages of AI in Primary and Secondary Education.

Article’s Title	Examined Topics	Level of Education	Citation (Year)
AI-Based Learning Style Prediction in Online Learning for Primary Education	i. Artificial Intelligence (AI)-based learning style. ii. Personalized Learning	Primary Education	(2022) <sup>23</sup>
Cyber physical Systems in K-12 Education	i. Supervised Machine Learning iii. Generative AI	Primary Education	(2022) <sup>26</sup>
Artificial Intelligence education for young children: Why, what, and how in curriculum design and implementation	i. Knowledge- Based Systems ii. Supervised Machine Learning iii. Generative AI	Young Learners	(2022) <sup>31</sup>
Artificial Intelligence for Student Assessment: A Systematic Review	i. AI for Tutoring ii. AI for Educational Assessment iii. Other Educational Uses of AI	All levels	(2021) <sup>12</sup>
Transformative effects of ChatGPT on modern education: Emerging Era of AI Chatbots	AI Chatbots	Higher Education	(2024) <sup>11</sup>
LIA: A Mathbot Assistant for First-grade Students	AI Chatbots	Primary Education	(2021) <sup>20</sup>
Do AI chatbots improve students’ learning outcomes? Evidence from a meta-analysis	AI Chatbots	All levels	(2023) <sup>30</sup>

**Table 2:** Articles for the Ethical Use of of AI in Primary and Secondary Education.

Article’s Title	Ethical Principles	Level of Education	Citation (Year)
Artificial intelligence in education: Addressing ethical challenges in K-12 settings	i. Privacy Concerns ii. Surveillance iii. Autonomy iv. Bias and discrimination	Primary Education	(2021) <sup>4</sup>

Ethical principles for artificial intelligence in education	i. Governance and stewardship ii. Transparency and accountability iii. Sustainability and proportionality iv. Privacy v. Security and Safety vi. Inclusiveness	All levels	(2022) <sup>21</sup>
Emerging challenges in AI and the need for AI ethics education	i. Privacy Concerns ii. Bias and discrimination	All levels	(2020) <sup>5</sup>
Ethics of AI in Education: Towards a Community-Wide Framework	i. Data ownership and control ii. Privacy iii. Limitations of data, bias and representation iv. Transparency and intelligibility	All levels	(2021) <sup>14</sup>
Ethical principles for artificial intelligence in K-12 education	i. Transparency ii. Justice & fairness iii. non-maleficence iv. Responsibility v. Privacy vi. Beneficence vii. Freedom & autonomy	Primary Education	(2023) <sup>2</sup>
Artificial Intelligence Ethics Guidelines for K-12 Education: A Review of the Global Landscape	i. Transparency ii. Justice & fairness	Primary Education	(2021) <sup>1</sup>

### 3. Ai-Powered Tools for Enhancing Students' Interaction and Engagement

Students are being offered plenty of benefits in their education through the employment of AI in Primary and Secondary education, transforming the traditional way of learning. Students enjoy personalized learning experiences through AI that respond to their individual needs and preferences<sup>3</sup>. With the ability to scrutinize vast data like their learning styles, performance records, and personal progress, AI tools can come up with specific personalized learning methods. The strongest advantage is that students can progress at their own pace, explore areas that pique their interest, and get extra support where they are struggling the most. This can lead to students feeling more motivated and engaged, helping them to gain a deeper understanding of the subject matter<sup>18</sup>.

Furthermore, AI enables adaptive and intelligent tutoring systems that provide personalized guidance and support to students (Alam, 2022)<sup>5</sup>. These systems use machine learning algorithms to analyze students' responses, assess their understanding and provide tailored feedback<sup>7</sup>. AI powered tools can adjust teaching strategies based on students' progress and dynamically adjust the difficulty of assignments. This adaptability ensures that students are adequately challenged and receive all the support and feedback they need to overcome various learning disabilities. By providing personalized tutoring, AI enables Primary and Secondary school students to take an active role in their education and helps them build confidence in their learning outcomes.

The students' learning experience could greatly benefit from AI's ability to access numerous educational resources and tools. With AI-powered platforms, students explore a variety of educational content that includes videos, articles, and interactive simulations, tailored specifically to their interests and learning

goals<sup>15,17</sup>. The available resources are greatly expanded, and students may use this opportunity to discover new topics and experiment with different approaches to learning. Incorporating artificial intelligence in secondary education can provide students with access to a variety of resources such as virtual museums, smart cities, and virtual laboratories. This helps teachers to automate administrative tasks and allows them to spend more of their time on providing personalized instructions and support to their students.

One AI-powered tool that is suitable for primary education students is MathBot<sup>13</sup>. Mathot, is an interactive virtual automated text-based tutoring system that explains math theories, provides practice questions, and offers students extensive feedback. It can assess students' math skills and knowledge through adaptive assessments and identify areas where they may need additional support or challenges. Based on the assessment results, the AI tool generates customized lessons and practice problems for each student, targeting their specific needs and learning goals. It uses a conversational interface to engage students in interactive math activities with step-by- 4 step explanations and feedback. It can adjust instructional strategies based on student responses and provide hints and guidance when needed. MathBot also tracks student progress, enabling students and teachers to monitor progress and identify areas that require further attention.

The Virtual Science Laboratory is a cutting-edge AI-powered tool created to transform secondary school students' science education. Students may explore the intriguing realm of scientific inquiry through its realistic simulations and interactive activities without being constrained by actual resources or equipment. The application provides a large variety of experiment simulations covering numerous scientific fields, such as biology, chemistry, and physics. Students should adjust variables, take the results in real time, and conduct data analysis to enhance their

comprehension of fundamental scientific ideas. The Virtual Science Laboratory fosters students' curiosity and helps them develop critical thinking skills as they investigate, formulate hypotheses, and draw conclusions from their experiments by offering a secure and interesting virtual environment. The tool further emphasizes fostering security and appropriate laboratory procedures. Students learn crucial procedures, such as handling hazardous products, donning protective gear, and keeping a clean workspace, through in-depth safety training modules and simulations. The tool makes sure that students form responsible habits and have a thorough understanding of potential risks in a laboratory setting by highlighting the importance of safety.

#### 4. Ethics and Ai

“Digital ethics is an essential 21st-century skill, along with metacognition, adaptability, creative observation, and the ability to multitask”<sup>22</sup>. Digital ethics is a sub-field of applied ethics which focuses on the study of moral reflection and evaluation of the ethical dilemmas arise in the development of information technology in various social contexts and the regulatory behavioral framework in the digital ecosystem to ensure compliance with human values and trustworthy use of technology on our society and the environment at large. The issue of ethics in the information environment is currently discussed by researchers using different concepts including information ethics, communication ethics, human computer interaction, human-artificial intelligence and the term of electronic culture as a model of interaction in e-business, education, medicine, e-governance and social media settings.

This paper adopts the principles of digital anthropology and has a human centric approach focusing on the study of human identity and behavior under the influence of technology. This paper discusses four ethical principles rooted in European Union human rights, which must be respected by stakeholders in education to secure the responsible implementation of AI and digital technologies. These principles are:

- Respect for human autonomy
- Prevention of harm
- Fairness
- Explicability

Autonomy is a fundamental human value and plays an important role for our moral and academic institutions. Progress in AI has opened new opportunities for fostering human autonomy and improved people's lives by saving them time on mundane tasks and improving the efficiency of human work. Though the case of Cambridge Analytica and of AI facilitated technologies for human deception, coercion and manipulation, reveals the complexity that surrounds the ethical implementation of AI. Autonomy is a notoriously vague term in the literature, but most theories agree that liberty and agency are the two major dimensions of autonomy<sup>27</sup>. To this extent, automated solutions and AI tools in education may save time and improve students' productivity but as<sup>29</sup> Argue:

*“We also see widespread deskilling, atrophy, ossification of practices, homogenisation and cultural diversity.”*

**Case:** A school implements an AI-based tutoring system that uses sophisticated algorithms to provide personalized instruction and feedback to students. The AI system monitors students' progress, identifies areas of improvement, and tailors' instructional content accordingly. However, some students express concerns about the AI system's influence, feeling that it

limits their freedom to explore alternative learning methods or pursue their own interests.

In the above case, AI experts and educators should limit the role of AI tools to provide recommendations and showcase to students diverse learning opportunities. But, to protect students' liberty and agency, for every action designed for AI tools, the empowerment of students' interaction and human choice should be taken into consideration.

AI systems should safeguard human dignity and mental and physical integrity. AI systems and their operating environments must be safe and secure. Particular attention must be paid to situations in which AI systems can cause or exacerbate negative effects due to power or information imbalances, such as those between employers and employees, businesses and consumers, or governments and citizens. Algorithms are the core elements of AI. Nowadays, algorithmic decision making is the norm in the private and public sector. Whenever people create algorithms, they also create a set of data susceptible to bias (Smith, 2020)<sup>28</sup>. How can we ensure that AI systems used in education do not perpetuate bias or discriminate against certain groups of students? Is there a risk that the AI tutoring system might unintentionally reinforce negative stereotypes or provide unfair evaluations and feedback based on individual characteristics such as race, gender, or socioeconomic background?

The increasing implementation of AI and reliance on decision making, have made the need for fairness and non-discriminatory algorithms an urgent task. Fairness as an ethical value needs to be redefined by AI policymakers, including a socio-relational dimension.

**Case:** A school district introduces an AI-powered grading system that automatically evaluates students' assignments, providing scores and feedback. However, it is discovered that the AI system consistently assigns lower grades to students from marginalized communities compared to their peers from privileged backgrounds, even when their work is of comparable quality. This raises concerns about the fairness and potential bias of the AI system.

Through this scenario the below questions are raised: How can teachers and educators play a role in ensuring fairness in AI education? Should teachers have the ability to review and validate AI-generated evaluations?

Explicability or explainability is related to transparency and is an important ethical consideration in the implementation of AI in education. Explicable AI (XAI) is proposed as a way to improve trust in algorithmic education via the use of interpretable language.

**Case:** A school district implements an AI-based adaptive learning platform that provides personalized learning recommendations to students. However, students and teachers express concerns about the lack of transparency in how the AI system arrives at its recommendations. They find it difficult to understand why certain learning materials or paths are suggested, and this lack of explicability hinders their trust in the system. Reviewing the above case AI experts and educators should reflect on strategies to enhance explicability in the design of AI algorithms and provide justifications and recommendations for their decisions while preserving privacy and confidentiality. XAI researchers have to address the below questions:

Can explicability help identify and address biases in AI systems?

How can explicability empower students, enhance their



engagement in the learning process and provide educational insights beyond mere system transparency? XAI is not a full solution to secure trustworthy AI but is a precondition to secure transparency and address algorithmic bias.

All the above scenarios will be implemented in Public Primary and Secondary Schools through the Greek National Project of the Ministry of Education UB<sup>7</sup>. Development of Innovation Centres in 13 Regional Directorates. The project intends to Strengthen the digital potential of education and modernization of vocational education and training. It concerns the development of thirteen (13) innovation centres in the respective educational regions of Greece, supported by one (1) virtual innovation centre which will support them and supply the others with educational material, support material, support services, training services, etc. The project aims to create a knowledge ecosystem (Innovation Centres) within the framework of compulsory education levels, which will integrate and interconnect: the school community, the local community, research institutions, universities, and local businesses, while interconnecting with similar educational ecosystems in Europe and elsewhere in the world. The Innovation Centres will be purpose-built, high-quality STE(A)M learning environments, green growth, and innovation promotion in general. Each workshop can be designed to support multiple curriculum themes and modules to meet the unique and distinct educational needs of each community. The Innovation Centres will visit schools from the region, based on specific programming, so that students can utilize the infrastructure, be introduced to new technologies, form opinions and direct their interest.

## 5. Discussion

The presented research delves into the convergence of primary and secondary education with artificial intelligence (AI), encompassing AI-driven tools' merits, ethical quandaries, and responsible AI utilization scenarios. The discourse discerns the broader implications of these findings in the realm of educational technology and the ethical considerations intertwined within.

The paper adeptly underscores the advantages that AI contributes to education. Notable gains include tailored learning experiences, adaptability, and the enhancement of conventional pedagogical methods. Illustrative instances such as MathBot and virtual science laboratories serve to exemplify how technology can effectively cater to individual student requisites while fostering active engagement. This emphasis on customization and interactive learning closely resonates with the evolving educational landscape, which places considerable emphasis on personalized learning experiences<sup>18</sup>.

However, the paper underscores the ethical implications of AI implementation in education and raises the questions about the degree of control students should retain in their educational journey. By focusing on the principles of human autonomy, prevention of harm, fairness, and explicability, the discussion recognizes the delicate balance that educators and policymakers must strike between technological advancement and ethical responsibility. The highlighted scenarios bring these concerns to life, illustrating potential ethical challenges that need to be navigated.

Furthermore, the paper's examination of equity and bias assumes a pivotal role. As Artificial Intelligence (AI) systems progressively integrate into assessment and recommendation processes, the matter of equity gains paramount importance. The paper astutely illuminates the peril of AI systems perpetuating

bias and raises queries about their potential inadvertent discrimination against specific student demographics. The notion of algorithmic bias is an enduring apprehension in AI ethics, and the paper's spotlight on its implications within the educational domain is profoundly pertinent<sup>28</sup>.

The concept of interpretability, denoting the transparency of AI systems, emerges as a central ethical contemplation. The paper's scrutiny of instances where AI-generated recommendations lack transparency spotlights the necessity for students and educators to grasp the rationale underlying AI-derived suggestions. This transparency not only fosters trust in AI systems but also empowers stakeholders to critically engage with AI-generated content.

The paper's proposition of responsible employment of AI scenarios presents a pragmatic strategy to mitigate potential ethical quandaries. These scenarios underscore the significance of endowing students with the apt use of AI while concurrently upholding transparency and impartiality. The concept of collaborative involvement among educators, policy formulators, and AI specialists to formulate ethical benchmarks resonates effectively. This collaborative synergy assures the evolution, integration, and oversight of AI technologies in ways that place primacy on the holistic growth and academic welfare of students.

## 7. Conclusions and Future Work

Advantages of AI in education include personalized learning experiences tailored to individual student needs, efficient assessment and feedback mechanisms, and the ability to augment traditional teaching methods with interactive and engaging content. Striking a balance between technological advancement and maintaining human-centered, equitable education becomes paramount. Statista (Citation 2020) estimates the AI market as a whole will be worth \$126 billion by 2025. The application of algorithmic intelligence by thousands of educational institutions as extension of the move towards digitalization has revolutionized education. AI ethics is a rapidly growing field, which currently cannot keep pace with the development of AI systems in our society. Though there is a growing awareness on the ethical implications of AI and the risks that are potentially introduced to human autonomy, limited research, policies, and regulations have been initiated to address the "mammoth" task of the use of trustworthy AI in education. Most studies examine students and educators' perceptions and challenges regarding the application. Ethics is a topic that needs to be addressed through the lenses of interdisciplinarity. A holistic approach by AI experts, philosophers, psychologists, linguists, lawyers, sociologists could lead to the identification of inclusive solutions. Continuous evaluation and auditing the lifecycle of AI by all stakeholders is also crucial to secure Explicable and Trustworthy AI (XTAI). "As soon as algorithms have effects in the world, they must be regulated and their programmers subject to ethical and legal responsibility for the harms they cause"<sup>9</sup>. To conclude, the findings of this research strongly underscore the indispensable role of ethical considerations in shaping the amalgamation of AI in educational settings. The transformative potential of technology in educational contexts necessitates a thoughtful approach aligned with human-centric values. While the study establishes a robust foundation for understanding AI's ethical dimensions in primary and secondary education, a more comprehensive exploration of technical solutions and the inclusion of educators and institutions in the discourse could potentially enhance its pragmatic applicability.

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