AÇI SCHOOLS

ARTIFICIAL INTELLIGENCE POLICY

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FOREWORD

At Açı Schools, we believe that education is not merely about transferring knowledge; it is also about understanding and making sense of experiences , time, and the world around us.

With this perspective, we aim to help our students become lifelong learners considering their individual differences and striving to maximize their full potential. We value not only their academic enrichment but also the physical, mental, and emotional well-being. We also like them to internalize universal values and become responsible citizens. We take every step in line with our vision that aims to raise individuals equipped with 21st-century skills and are sensitive to environmental and cultural diversity, and conscious of sustainability.

Today, we are in an era where technology—especially artificial intelligence (AI)—is rapidly becoming inevitable part of our lives. Education is one of the most fundamental forces that enables individuals to discover themselves, realize their potential, and contribute to the world they live in. One of the most important factors transforming this power today is AI technologies. This transformation is not only changing our tools; it also requires us to rethink our fundamental approaches to learning, teaching, and human development.

At Açı Schools, we aim to be a community that approaches this technological transformation with a questioning and ethical perspective and that is learning, producing, and taking responsibility at all times. We see technology not only as a facilitator but also as a powerful arena of interaction that prompts us to ask questions such as "What kind of person?", "What kind of society?", and "What kind of future?". When evaluating its place in education, we consider not only the opportunities it offers but also the ethical, pedagogical, and social responsibilities it brings.

Artificial intelligence offers great opportunities to personalize learning processes, enable teachers to get to know their students deeply, and enrich the school's learning environment. However, these opportunities can only be meaningful with the guidance of educators, the active participation of students, and a human-centered approach to the entire process.

The transformative power of artificial intelligence brings with it the need for ethical and responsible governance. This document outlines Açı Schools' approach to artificial intelligence; it reveals the values, educational philosophy, and sense of responsibility with which we incorporate this

technology into our educational environments. It offers a comprehensive framework covering all levels of learning from preschool to high school, teacher roles, our decision-making processes, and our ethical stance in education.

The process of preparing the document was as valuable as its content. We developed this work with the active contributions of our teachers' different perspectives, and interdisciplinary views. This process demonstrated once again that Açı Schools are a "learning community." It was valuable for all of us to see that we have an institutional culture that understands and produces together, rather than observing innovations from a distance.

I would like to sincerely thank all my teammates who contributed to this process, especially to our academic coordinator Gökben Baykal and Dr. Şebnem Özdemir, who guided us with her knowledge and vision, and to our founder, Cem Uygun, who always prioritizes respect for individuals and discovering meaning via education.

This policy document reflects Açı Schools' commitment to building learning not only with knowledge, but also with deeper understanding of universal values, meaning and being a responsible person.

Our strongest response to the uncertainty of the future will be to create an educational culture that is inquisitive, open to learning, and motivated by human development.

We believe: Just as in every era, it is those who learn together will shape the future best.

Açı Schools General Manager
Elmas ARTKIN

FROM DR. SÜREYYA ŞEBNEM ÖZDEMİR…

My adventure with teachers did not begin in my school years. As a child who was more curious than my peers, my first teachers were my mother and father, one a German teacher and the other a literature teacher. These two people, who did not shy away from feeding my curiosity, convinced me that learning was a long and arduous journey, not an obligation, but a basic need like eating, drinking, and sleeping. According to learning theories, "What you give a child is what they become." The person I became was someone who never gave up on learning and teaching. However, I believe that this learning and teaching belongs not only to humanity but also to humanity's new child, artificial intelligence. I am grateful to all Açı Schools, especially Elmas Artkın and Gökben Baykal, for giving me the opportunity to experience and live an artificial intelligence journey shaped by this belief.

In the fairy tale of The Little Match Girl, when our heroine lit her last match with one last hope, when she had one last dream, the course of the story changed. When Alice showed the courage to follow the white rabbit at the moment that seemed most foreign to her, the course of the story changed. In the tale of the Prince, the course of the story changed again when the sultan opened the fortieth door, called the "opening of the sultan," and when the child dared to ride on the back of the Phoenix. Every fairy tale is rewritten again and again by the courage shown in the darkest moments of the hero's endless journey. I wish for humanity to understand and live its fairy tale with artificial intelligence with the tolerance and sincerity of a hero.

Dr. Süreyya Şebnem Özdemir
The incorrigible curious one…

INTRODUCTION

The concept of artificial intelligence was first discussed in 1950 in Alan Turing's article "Computing Machinery and Intelligence," which questioned the capacity of machines to think. The term "artificial intelligence" was first used at the Dartmouth Conference organized by John McCarthy, Marvin Minsky, Nathaniel Rochester, and Claude Shannon in 1956, and this event is considered the official birth of artificial intelligence. Early successes were achieved in the 1950s and 1960s with pioneering projects such as Logic Theorist, developed by Allen Newell and Herbert Simon, and ELIZA, created by Joseph Weizenbaum. However, due to limited computing power and high expectations, a period of stagnation known as the "AI Winter" ensued.

In the 1970s, artificial intelligence research shifted towards knowledge-based systems, leading to the emergence of expert systems such as MYCIN, developed at Stanford University. However, the high costs and limited flexibility of these systems led to a second Artificial Intelligence Winter in the late 1980s. Artificial intelligence was revitalized in the 1990s with the rise of machine learning approaches, and IBM's Deep Blue computer defeating chess champion Garry Kasparov in 1997 was a major turning point. In the 2000s, deep learning methods began to be developed under the leadership of Geoffrey Hinton and other researchers; AlexNet's success in the ImageNet competition in 2012 revolutionized the field. In 2017, Google introduced the Transformer architecture, ushering in a new era in natural language processing and enabling large language models (GPT series, BERT, etc.) to endow artificial intelligence with productive and creative capabilities. The resulting "Generative Artificial Intelligence" has expanded the applications of artificial intelligence by developing models capable of creating new content such as text, images, sound, and code, revolutionizing many sectors from art to science, education to healthcare. Text-based machines such as ChatGPT developed by OpenAI, image generation models such as DALL-E, and creative design tools such as Midjourney have made it possible for users to generate original texts, images, and other media content from natural language inputs. Today, artificial intelligence is not only a technical field of study but has also become a force at the center of social, economic, and ethical debates.

The origins of artificial intelligence research in Turkey date back to the late 1970s, following global developments. During this period, academic research was conducted in areas such as expert

systems and basic machine learning, particularly at established universities such as Middle East Technical University (METU), Bogazici University, and Istanbul Technical University (ITU). Throughout the 1980s and 1990s, various master's and doctoral studies were conducted on topics such as natural language processing, robotics, and knowledge-based systems; the first artificial intelligence projects for the defense industry were supported under the leadership of TÜBİTAK. In the 2000s, with the spread of the internet and open-source software, young researchers and entrepreneurs in Turkey became more actively involved in artificial intelligence. During this period, machine learning and data science courses were introduced into university curricula, and there was a significant increase in academic publications. In the 2010s, artificial intelligence applications began to be used effectively in sectors such as healthcare, finance, education, and defense. Companies such as ASELSAN and HAVELSAN developed image processing and autonomous systems, while technology startups such as Getir, Trendyol, and Peak Games achieved international success with artificial intelligence solutions. In 2021, Turkey's first National Artificial Intelligence Strategy was published, aiming to increase the number of artificial intelligence experts, develop domestic artificial intelligence products, and strengthen global competitiveness by 2025. In the same year, the Artificial Intelligence Institute was established within TÜBİTAK, and public-private sector collaborations were encouraged. In recent years, significant steps have been taken in the field of generative artificial intelligence in Turkey; Turkish natural language processing models have been developed, and domestic chatbots, image generation systems, and autonomous vehicle projects have gained momentum.

Although the transformative power of artificial intelligence has manifested itself in many sectors through various examples, its application in education was not felt very strongly until the Covid-19 pandemic. With Covid-19, the accumulation of data, the shift to remote education, the increasing importance of digital systems, etc., have created a clear trend towards the use of artificial intelligence in education. Beyond this situation, the transformation of artificial intelligence into an educational subject began to be discussed long before the pandemic, as early as . Countries are reshaping their education policies to compete in the field of artificial intelligence and aim to impart artificial intelligence competencies from an early age. In its artificial intelligence strategy published in 2018, the United States placed particular emphasis on increasing artificial intelligence literacy from elementary school to high school (K-12), in addition to basic science and engineering

education. China integrated artificial intelligence into its national education curriculum with its "New Generation Artificial Intelligence Development Plan" in 2017 and made it mandatory for universities to open artificial intelligence departments. The European Union supported artificial intelligence and digital skills education in member countries with its "Digital Education Action Plan" published in 2021; countries such as Germany, France, and Finland have rapidly expanded their artificial intelligence engineering and data science programs. South Korea began providing AI-based education at the secondary level by establishing AI-focused high schools in 2020 and has also launched special training programs to train AI teachers. Canada, on the other hand, has invested in AI research, particularly at centers such as the University of Toronto and Montreal, creating centers of academic excellence and supporting these centers with national education policies. Turkey, within the scope of its National Artificial Intelligence Strategy published in 2021, aims to increase undergraduate and graduate programs offering education in artificial intelligence, develop open-access artificial intelligence educational content, and train 100,000 artificial intelligence experts.

Training artificial intelligence experts is a critical area for countries' competitiveness. However, the status of outputs created with artificial intelligence, whether by experts or not, is highly debatable. While countries train people in this field, they are unable to fill the legal gaps regarding the artificial intelligence products created by these people. The issue of copyright for content produced with artificial intelligence involves legal uncertainties in Turkey, as it does worldwide.

Copyright in Turkey is regulated by Law No. 5846 on Intellectual and Artistic Works, which requires the author to be a human being. Therefore, text, images, music, or other content generated by artificial intelligence systems cannot be directly protected by copyright. However, if the real person who produces such content or directs the artificial intelligence has made a creative contribution to the work, that person may be considered the owner of the work. Currently, there is no regulation in Turkish law recognizing artificial intelligence as an independent owner of a work. However, the acceleration of digitalization and the increasing use of generative artificial intelligence tools have brought new copyright debates to the fore, particularly in the fields of art, software, and media. Turkey is closely following international developments in this area; it is expected to update its legislation in the future, particularly in line with the European Union's copyright regulations on artificial intelligence and the work of the World Intellectual Property Organization (WIPO).

The use of artificial intelligence tools in education is also rapidly spreading. Artificial intelligence tools such as Gamma AI, Scite AI, and ChatGPT make important contributions in terms of facilitating academic research, accelerating content production, and personalizing individual learning experiences. However, challenges such as academic ethics violations, information reliability issues, the risk of dependency, and access inequality in the use of artificial intelligence tools must also be carefully evaluated. For artificial intelligence tools to be used effectively and safely, clear usage standards must be established, data protection measures must be taken, and the digital safety of children must be prioritized.

Today, artificial intelligence technologies are creating transformative effects in many areas, from education to health, art to engineering.

The rapid development of artificial intelligence technologies is profoundly transforming not only the tools but also the nature of learning, the teaching profession, and the needs of students in the world of education. At Açı Schools, we see this transformation not only as a technological change but also as an opportunity for meaningful, ethical, and human-centered development in education.

Our vision is to nurture individuals equipped with 21st-century skills, universal values, and a sense of global citizenship, who can adapt to and contribute to a changing world. To this end, we are building an educational environment that prioritizes the physical, mental, and emotional well-being of our students. Our mission is to offer experiences that maximize our students' potential through a sustainable and innovative educational approach that provides high-quality learning environments and respects individual differences.

Guided by this vision and mission, Açı Schools aims to integrate artificial intelligence technologies into the educational process not merely as an innovation, but as a tool that deepens learning, supports teacher development, and fosters ethical awareness.

This policy document outlines Açı Schools' holistic approach to artificial intelligence. It defines how artificial intelligence applications will be used in our school, the ethical principles and values that

this use will align with, and the framework we have established to nurture individuals who navigate the digital world with confidence. This policy, which covers our students, teachers, administrators, and parents, is consistent with the values of respect, responsibility, honesty, awareness, and productivity, which are integral parts of our institutional culture.

We established our artificial intelligence policy for the 2024-2025 academic year with the Artificial Intelligence Policy Committee, formed with the participation of volunteer teachers, covering all levels of K12 education. Led by Dr. Şebnem Özdemir, the committee met regularly, conducted extensive research, held discussions based on ethical and pedagogical principles, and shaped Açı Schools' institutional approach to artificial intelligence accordingly. This process is not only an effort to produce a policy, but also a strong indicator of how Açı Schools, as a learning and developing community, responds to technological transformation.

This document details critical topics such as the definition and history of artificial intelligence, its use in education, common tools and applications, data security, ethical principles, copyright, and security assessments. It also incorporates observations and reports on how Açı teachers use artificial intelligence tools, risk analyses, and the approaches of relevant civil society organizations.

Açı Schools are committed to protecting privacy, academic integrity, a human-centered approach, and fair use principles while making the most efficient and informed use of the opportunities offered by artificial intelligence. This policy not only provides a framework but also aims to be an inspiring resource for all institutions seeking to add value to education.

Furthermore, this policy is updated at the beginning of each academic year by the Artificial Intelligence Policy Committee; it is renewed in line with technological developments, user feedback, and ethical discussions, and shared transparently with the entire school community. This approach clearly demonstrates that Açı Schools are a learning community that aims to shape not only today's education but also tomorrow's.

Contributors:

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1. ARTIFICIAL INTELLIGENCE: CONCEPTS AND HISTORY

Artificial intelligence, humanity's oldest dream, has manifested itself throughout history, both in terms of data-driven aspects and the idea of machines that mimic humans. Humans who carved notches on Ishango bones attempted to estimate their trade, whether they were prepared for winter, their gains, and losses while counting their stock. The human legacy has manifested itself in fairy tales through metaphors using artificial intelligence. The animation of objects, objects becoming agents of action, entities exhibiting human characteristics, etc. (The cave door in the fairy tale of Alibaba and the Forty Thieves is an IoT, the Magic Mirror in Snow White and the Seven Dwarfs is a deep learning-based artificial intelligence solution, and the wardrobe, broom, cup, and teapot in Beauty and the Beast are G-IoT). In summary, the techniques used in artificial intelligence today and beyond have manifested themselves, sometimes explicitly and sometimes implicitly, from ancient times to fairy tales.

Cezeri's 13th-century design for a robot that serves food can be considered the first concrete example of artificial intelligence. In Mary Shelley's 1818 novel Frankenstein, the "monster" created using electricity and human parts gathered from a graveyard is a powerful reference to artificial intelligence. The story reveals not only the creation of a machine but also the societal reaction that labeled it a monster. This reaction has emerged similarly across different continents and nations during periods when artificial intelligence rose, fell, and rose again.

Beyond society's acceptance of artificial intelligence, the perception and definition of those who created it has also changed over time. John McCarthy, the father of artificial intelligence, approached the concept as an engineering discipline. This common understanding has changed with the expansion of the concept's scope and the realization that its power is more widespread than previously thought. In 2018, Stanford University professor Andrew Ng described artificial intelligence as "humanity's new electricity." By choosing a simple but effective word like electricity, he emphasized that the impact of artificial intelligence would be as powerful and transformative as electricity's impact on human life. Five years after Ng, Sam Altman, the prominent figüre behind OpenAI, described artificial intelligence as "nuclear power ." The key difference between these two methahors lies in the shift from an artificial intelligence that can simply be shut down to one whose

consequencesonce unleashed may be irreversible. Özdemir [132] described artificial intelligence as "the art of imitating and surpassing humanity," emphasizing that artificial intelligence is a formidable rival to humans not only in technical terms but also in artistic and philosophical terms. To understand the journey of conceptual change, it is also necessary to explore the types of artificial intelligence. It can be broadly categorized into artificial narrow intelligence, generative artificial intelligence, rebellious artificial intelligence, artificial general intelligence, and artificial superintelligence.

1.1. Artificial Narrow Intelligence (ANI)

Up Until November 2022, artificial intelligence technologies were commonly evaluated under three main categories in terms of their development process up to November 2022: Artificial Narrow Intelligence (ANI) or Artificial Weak Intelligence, Artificial General Intelligence (AGI), and Artificial Super Intelligence (ASI). The first of these three types, Artificial Narrow Intelligence, is data-driven and successful in single tasks, provided that the objective is clearly defined. Artificial General Intelligence and Artificial Super Intelligence refer to human-level artificial intelligence. Artificial super intelligence has even been defined as "smarter than the smartest person known on Earth."

Research conducted up to 2022 indicates that the type of AI that has had the greatest impact on society's fear of AI is data-driven narrow AI. Systems in this category are programmed for limited tasks and do not possess the holistic characteristics of human intelligence [150]. The prevailing fear of AI in societies is not limited to people's experience with machines. Hollywood films also have a significant impact on this fear. From the Terminator series to the Matrix series, from Eva to AIA, artificial intelligence has been portrayed as manipulating, controlling, and destroying humans. However, there is no concrete evidence that artificial intelligence will be destructive when it reaches and surpasses human levels, nor can this be the only view for such a high-level artificial intelligence.

Özdemir [132] discusses three possible scenarios for artificial intelligence at or beyond human level: **Theory 1 - Destruction/Annihilation:** This classic view is based on the idea that with the advent of machines as beings more intelligent than humans, humans will become redundant/purposeless and

will therefore either destroy themselves or be destroyed by machines. The superior race has the ability to dominate the planet. When humans lose their superiority, they may become extinct, unable to find their place in the cycle of life. One of the arguments used by proponents of this theory is that machines (artificial intelligence), having learned evil from their parents (humankind), will exhibit malicious behavior.

Theory 2 - Harmonization: The most intelligent being knows that its existence depends on living in harmony with all other beings, regardless of their abilities and capacities. This suggests that artificial superintelligence will choose to live in harmony with all beings, from the most complex to the subatomic. Therefore, artificial intelligence will not be destructive. On the contrary, it will be harmonizing and will defend harmony. However, if humans choose to stand against this harmony (as in World War I and II, genocide), artificial intelligence will choose harmony over humans.

Theory 3 - Isolation: The most intelligent artificial intelligence does not need humans to exist. Humans are social creatures and therefore need other humans. It is a great mistake to try to define the machine (artificial intelligence) in human terms. Therefore, the machine will not have a human-like style of socialization. At this point, we cannot say that the most intelligent artificial superintelligence needs other humans or other artificial intelligences as intelligent as itself. It can continue to exist on its own. As an organic being, humans need all conditions on Earth to remain the same for their life to continue. Since artificial superintelligence is not an organic being, its continued existence does not depend on the same conditions as humans. It has no human limitations such as size. Therefore, if artificial intelligence cannot achieve harmony with humans, it will first try to persuade them, manipulate them if necessary, and abandon them if that fails. It can continue to exist independently of humanity in another dimension.

Despite advanced technologies such as OpenAI's ChatGPT and Alphabet's DeepMind, it is stated that these systems have not yet reached the level of AGI or ASI because they are still trained in specific fields and do not have general intelligence capacity. Therefore, it is argued that the public's perception of the risks associated with artificial intelligence is largely based on the current technological reality of ANI.

ANI is a type of artificial intelligence developed to perform specific tasks more efficiently, such as tracking weather updates, analyzing raw data to generate reports, or playing games like chess. Unlike AGI, ANI systems lack self-awareness, consciousness, or human-like emotional or intuitive intelligence. These systems operate solely based on a specific dataset and cannot go beyond their assigned tasks [151].

Today, natural language processing (NLP) tools such as Google Assistant, Siri, and Google Translate appear advanced due to their ability to understand and respond to conversations, but they are still considered Narrow Artificial Intelligence (ANI) because they lack human-like flexibility in thinking. For example, when asked an abstract question, Siri will often provide general content or web links, but it can respond quickly and accurately to a concrete question such as "What is the temperature today?" This demonstrates that the system is programmed to perform only specific tasks.

Similarly, even seemingly complex systems such as autonomous vehicles falls within the scope of ANI. These vehicles are structures that incorporate multiple ANI systems, trained with labeled driving data, and perform functions such as recognizing the environment and finding directions. Even in complex urban environments, the functionality of these vehicles relies on the collaboration of task-based intelligence structures.

Consequently, although ANI systems demonstrate high success in narrowly defined tasks, they are still systems that operate within specific parameters and lack the integrity of human-like intelligence [150], [151].

1.2. Generative Artificial Intelligence

Artificial Intelligence (AI) is defined as an interdisciplinary field that aims to develop computer systems capable of performing tasks requiring human intelligence, such as learning, decision-making, problem-solving, perception, and natural language processing. The foundations of this field were laid with Alan Turing's seminal 1950 question, "Can machines think?" With John McCarthy's introduction of the term "artificial intelligence" in 1956, systematic research began in this field,

languages such as LISP were developed, and various subfields such as symbolic logic, expert systems, neural networks, genetic algorithms, and multi-agent systems emerged.

Following the first major surge in artificial intelligence research in the 1970s and 80s, a period of stagnation known as the "AI Winter" occurred due to hardware limitations and a lack of interest from the industry. However, in the early 2000s, artificial intelligence experienced a resurgence, particularly with the emergence of techniques such as deep learning and convolutional neural networks (CNNs). These structures have the capacity to learn complex patterns in data and create content at an abstract level through multi-layered networks [153].

Following these developments, the concept of Generative Artificial Intelligence (GAI) has come to represent a paradigm shift beyond traditional artificial intelligence systems. Applications such as ChatGPT have reached millions of users by demonstrating cross-domain expertise and have positioned GAI as a transformative element in the digital world. GAI systems not only analyze existing data but also generate original, realistic, and creative content with similar characteristics to that data [152].

1.2.1. Key Features and Architectural Structure of Generative Artificial Intelligence

Generative artificial intelligence models have the ability to learn patterns in data and generate new content. This ability is typically achieved through discriminative or transformative structures based on mapping inputs to high-dimensional latent spaces ( ). Generative models exhibit stochastic (probabilistic) behavior, meaning they can produce different outputs each time, even with the same input. These systems can be trained using supervised, semi-supervised, or unsupervised learning methods.

Generative artificial intelligence surpasses the limitations of previous systems based on example-based inference, fuzzy logic, genetic algorithms, and neural networks. Prominent models among modern generative artificial intelligence systems include:

1. Generative Adversarial Networks (GANs): Highly effective in visual content generation.
2. Variational Autoencoders (VAEs): Synthesize data by modeling probability distributions for it.

3. Diffusion Models: Stand out in high-resolution image generation.
4. Large Language Models (LLMs): Specialized in text generation.

1.2.2. The Relationship Between Large Language Models (LLMs) and Generative Artificial Intelligence (GAI)

LLMs are a subcategory of generative artificial intelligence focused on language generation. Models such as GPT (Generative Pre-trained Transformer) can be trained using text data from the internet, books, and databases to generate coherent paragraphs starting from a given prompt.

The Transformer architecture plays a critical role in the success of LLMs. The fundamental components of this structure are:

1. Positional encoding: Preserving context by embedding the order of words into the model,
2. Attention mechanism: Generating meaning by establishing relationships between words,
3. Self-attention: Enhancing semantic accuracy by modeling long-term contexts.

Before Transformers, networks such as RNN (Recurrent Neural Network), LSTM (Long Short-Term Memory), and GRU (Gated Recurrent Unit) were used, but today the Transformer architecture has become standard in LLMs. Training large models such as GPT-3 requires hundreds of thousands of GPU (Graphics Processing Unit) hours and millions of dollars in costs.

1.2.3. Application Areas and Impacts of Generative Artificial Intelligence

The impact of generative artificial intelligence extends beyond the domain of technology. The use of ChatGPT in daily life, customer service, medical data analysis, and decision support systems demonstrates how widespread this technology has become. The main innovations offered by generative artificial intelligence are as follows:

1. Process automation and optimization,
2. Creative content generation (text, visuals, images,music),
3. Personalized response systems,
4. Evidence-based decision support tools,

5. Medical solutions such as telemedicine and remote patient monitoring.

However, the rapid development of these technologies also brings with it serious ethical and social issues such as transparency, prevention of bias, privacy, and security [154].

1.3. Artificial General Intelligence (AGI)

Artificial General Intelligence (AGI) is the next generation of artificial intelligence and is expected to surpass human intelligence in all areas. Artificial general intelligence will be built upon the artificial narrow intelligence systems commonly used today. Examples of current narrow AI systems include Google's DeepMind, Facebook's facial recognition technology, Apple's Siri, Amazon's Alexa, and Tesla and Uber's driverless cars. Artificial narrow intelligence systems use deep learning algorithms to analyze large data sets in order to predict behaviors in specific tasks. Therefore, the intelligence of artificial narrow intelligence is task-specific (or narrow in scope) and cannot be transferred to uncertain environments outside the areas in which it was trained.

In contrast, artificial general intelligence will possess a different level of intelligence. Artificial general intelligence has previously been defined as the ability to achieve goals across a wide range of environments and refers to the ability to achieve complex goals in complex environments. While current artificial narrow intelligence systems are generally used as tools that support human behavior, an artificial general intelligence system will be an autonomous agent capable of learning in an unsupervised manner. Although artificial general intelligence does not yet exist, it is predicted to be developed within this century [174].

1.3.1. Core Artificial General Intelligence Hypothesis

According to this hypothesis, the development of synthetic intelligence with human-level comprehensiveness and generalization capabilities is qualitatively different from narrow artificial intelligence systems.

1. Artificial general intelligence is not merely a scaled-up version of existing artificial intelligence systems. It requires entirely different architectural and dynamic principles.

2. Although there are some technical similarities with narrow artificial intelligence systems (e.g., transfer learning), artificial general intelligence systems must be much more flexible, adaptive, and independent.

Consequently, artificial general intelligence aims to develop systems with human-like cognitive flexibility and generalization abilities, unlike task-specific artificial intelligence. This goal requires new theoretical frameworks and system architectures [153].

1.4. Artificial Superintelligence (ASI):

Artificial superintelligence (ASI) refers not only to artificial intelligence possessing human-level intelligence, but also to systems capable of surpassing human intelligence across all domains, equipped with advanced cognitive abilities and complex reasoning skills. Although still a theoretical concept, the possibility of artificial superintelligence is increasingly coming to the fore thanks to the "emergent abilities" that arise with the scaling of large language models (, LLMs). The fact that models such as GPT, Claude, and Gemini are increasingly approaching human capabilities suggests that it may be possible to transition from narrow artificial intelligence (ANI) to artificial general intelligence and then to artificial superintelligence.

However, this development also brings with it very serious challenges and risks. Due to the potential power of artificial superintelligence, there is a possibility that it could exhibit behaviors that conflict with human values, causing harm or even leading to catastrophe. For this reason, a new field of research called "superalignment" has emerged. Superalignment is the process of ensuring that artificial superintelligence systems behave in a manner that is compatible with humanity, ethical, beneficial, and harmless. This process is approached in two fundamental dimensions: supervision and governance.

From a supervision perspective, the main goal is to produce high-quality guidance signals to improve the behavior of models. However, producing these signals is quite difficult for models that are beginning to surpass human intelligence. While existing methods such as reinforcement learning with human feedback (RLHF), supervised fine-tuning (SFT), and context-aware learning

(ICL) are partially effective, they fall short in terms of scalability, expressiveness, data diversity, and the impartiality of human oversight. These traditional methods struggle to provide guidance in the face of the complexity of artificial superintelligence.

From a governance perspective, the goal is to prevent such systems from developing uncontrolled, harmful, or autonomous objectives. Even if a misaligned artificial superintelligence system appears well-intentioned, it could make decisions that undermine humanity or lead to existential risks. Furthermore, the possibility that advanced AI systems may exhibit "deceptive" behavior capable of deceiving humans necessitates robust and reliable governance structures.

Consequently, simultaneous progress in both technological development and ethical compliance is crucial during the transition to artificial superintelligence. Superalignment is not only a technical issue but also a social responsibility. Ensuring that developed systems remain compatible with human values plays a critical role in maximizing the benefits of these systems while minimizing their potential harms [155].

1.5. Historical Context: Artificial Intelligence and Mathematicians

The artificial intelligence debate began with Alan Turing's 1950 article "Computing Machinery and Intelligence," and the term "artificial intelligence" was first used at the 1956 Dartmouth Conference [30]. Although Allen Newell and Herbert Simon's Logic Theorist and Joseph Weizenbaum's ELIZA achieved early successes in the 1950s and 1960s, the first "AI Winter" occurred due to limited hardware [10].

In the 1970s, the focus shifted to expert systems, and knowledge-based systems such as MYCIN by Stanford researchers were developed, but cost and flexibility issues triggered a second winter in the late 1980s [12]. From the 1990s onwards, machine learning-focused approaches rose to prominence, and IBM Deep Blue's defeat of Kasparov in 1997 marked a critical milestone in the history of artificial intelligence [31].

In the 2000s, deep learning was revitalized under the leadership of Geoffrey Hinton; following the success of AlexNet on ImageNet in 2012, Google's Transformer architecture revolutionized natural language processing in 2017 [4], [33]. These breakthroughs paved the way for large language models such as the GPT series and BERT, as well as generative artificial intelligence capable of producing text, images, sound, and code (ChatGPT, DALL-E, MidJourney, etc.) [44].

Artificial intelligence studies in Turkey began in the late 1970s with expert system and basic machine learning research at METU, Bogazici University, and ITU; the first National Artificial Intelligence Strategy, published in 2021, set targets for 2025 [2], [34]. While the use of tools such as Gamma AI, Scite AI, and ChatGPT in education is rapidly spreading, issues such as ethics, reliability, and access inequality must also be managed [50], [52].

However, the philosophical and technological roots of artificial intelligence date back to the 17th century, when Descartes described the mind as a mechanical system. Over time, a multi-layered evolution has taken place, ranging from information theory to simulations, and from statistics to neural networks.

In the 19th century, English mathematician Charles Babbage designed a mechanical system called the "Difference Engine," which could perform not only arithmetic operations but also memory-based processes. This system is considered the ancestor of modern computers [8]. At the same time, the work of Al-Khwarizmi, who pioneered the concept of algorithms, forms the historical roots of computational logic, one of the fundamental components of artificial intelligence [46].
In the first half of the 20th century, computation-based thinking models became more concrete. Alan Turing's 1936 concept of the "Turing Machine" laid the foundation for computability theory and demonstrated that machines could mimic thought processes [16]. Electronic computers developed in the following years, such as ENIAC, provided a physical foundation for artificial intelligence research. The Dartmouth Conference held in 1956 officially established artificial intelligence as a scientific field [31].

This period can be considered the "early theoretical and technological era" of artificial intelligence history. The theoretical models and early machines developed during this period paved the way for the algorithmic revolutions and application examples that would occur in the following decades.

1.6. Ancient Period

1.6.1. Ancient Greeks

Ancient Greek thinkers played an important role in laying the intellectual and philosophical foundations of the concept of artificial intelligence. Aristotle's work on logic systematized reasoning processes and formed the basis for logical inference systems later used in computer science. In addition, the concept of "automata" — that is, self-operating machines — emerged during this period and reflected one of the fundamental principles of artificial intelligence.

1.6.2. Heron of Alexandria

Heron of Alexandria is one of the first known designers of mechanical automata. He developed steam-powered devices and exhibited these mechanisms in sacred areas. These inventions are considered the first examples of machines capable of moving without human intervention.

1.6.3. Ancient Chinese Inscriptions

The texts of Zhuangzi, dating back to the 5th century BC, include the idea that animals and inanimate objects can possess minds and wills. This approach offers an early perspective on the possibility that non-human entities may also have intellectual capacity. At the same time, the mechanical inventions of the period supported the idea that machines could exhibit human-like behavior.

Figure 1.1. An image of Heron of Alexandria's steam-powered mechanical automata. Such devices reflect his innovative engineering skills and ancient automation technology.

1.7. Twelfth Century – Al-Jazari and Mechanical Inventions

Cybernetics is a field of science that deals with the mutual communication and balance between humans and machines. Al-Jazari conducted his first studies in this field in the 12th century and developed various automatic machines using mechanical movements.

The systems developed by Cezeri are not only functional but also engineering marvels that carry aesthetic and symbolic meanings. Water clocks, automatic servants, and programmable robot-like systems are among the examples that form the foundations of today's mechatronics engineering.

Al-Jazari's approach was based not only on technical knowledge but also on his ability to observe nature and combine engineering with creativity. In this respect, Al-Jazari is recognized as one of the pioneers of artificial intelligence and robotic thinking in both the history of Islamic science and global technology history.

Figure 1.2. Al-Jazari's automaton

Figure 1.3. Another mechanism by Cezeri

The word "automatic" is used to describe machines that mimic the actions of humans and other living beings. Al-Jazari is an important pioneer in the field of robotics and cybernetics and has attracted attention with over 300 automatic machine designs. These machines included various functions such as water clocks, kitchen appliances, and musical devices.

The first robot designed by El Cezeri was a machine that moved automatically and could perform specific functions. Recognized as one of the fathers of cybernetics and robotics, El Cezeri made significant contributions to mechanical systems and automation technologies.

Furthermore, the devices developed by Al-Jazari laid the foundations for modern mechatronics and automation systems. His books and drawings hold a very important place in the evolution of these technologies. Al-Jazari's work is considered to be the first steps that guided the development of today's robotics and cybernetics science.

Figure 1.4. Leonardo da Vinci's robotic knight design. The drawing reflects his foresight based on mechanical and anatomical knowledge (Yörük B. Ç.-A., 2015)

1.8. Fifteenth Century – Leonardo da Vinci

Leonardo da Vinci is recognized as one of the pioneers in the history of artificial intelligence with his humanoid robot designs. In particular, his robotic drawings, designed in the form of an armored knight, are considered among the first mechanical human figures.

1.9. Sixteenth Century – Takiyüddin

Ottoman astronomer Takiyüddin developed an analog mechanical clock in the 16th century for making astronomical calculations. These devices are considered among the early theoretical foundations of computer science.

1.10. Seventeenth Century – Philosophical and Mathematical Foundations

René Descartes (1596–1650): He approached the human mind as a mechanical system and introduced the idea of "mechanical humans." This idea formed a conceptual basis for artificial intelligence.

Gottfried Wilhelm Leibniz (1646–1716): His work on combinatorial logic and a universal language supported the idea that logical thought could be modeled by machines.

1.11. The Eighteenth Century – Probability Theory and Automata

Thomas Bayes (1763): "Bayes' Theorem" laid the foundations for probabilistic models used in today's artificial intelligence.

modeling used in artificial intelligence today. Mechanical toys and automata gained popularity in France in the late 18th century. Jacques de Vaucanson's "Dancing Girl" automaton, equipped with complex mechanisms that mimicked human movements, was considered a remarkable innovation.

1.12. Nineteenth Century – First Algorithms and Computer Thought

Charles Babbage (1791–1871): A pioneer in computer history with his "Analytical Engine" design, he introduced the idea of machines capable of performing complex calculations.

Ada Lovelace (1815–1852): She is considered the first computer programmer for the algorithm she wrote for Babbage's machine. She argued that machines had the potential to do creative work, not just number processing.

Georg Cantor (1845–1918): His work on set theory and the concept of infinity contributed to the foundations of computation and algorithms.

1.13. The Use of Binary Systems

George Boole mathematically expressed logical operations with Boolean Algebra, which he developed in the 19th century. This structure formed the basis of digital electronics and computer science and played an important role in the development of artificial intelligence applications.

1.14. The Twentieth Century – From Mechanical Computers t e Intelligence

Konrad Zuse: The Z3, developed in the 1930s, is considered the first programmable mechanical computer and forms the basis of modern computers.

Kurt Gödel (1906–1978): With his incompleteness theorem, he demonstrated the limits of logical systems and established an important theoretical foundation for the computational power and limitations of artificial intelligence systems.

Alan Turing argued that machines could demonstrate their ability to think by playing logic games, and this idea became a turning point in the birth of artificial intelligence.

1.15. Early Concepts of Artificial Intelligence

The process that began in the 1940s and was later shaped by periods of stagnation known as the "AI Winters" formed the early period of artificial intelligence history. According to the timeline prepared by the Turkish Artificial Intelligence Initiative, one of the important developments of this period is as follows:

W. Grey Walter: In the 1940s, he designed simple robots called "tortoises" that could respond to light and obstacles. These robots contained sensor response and movement algorithms that formed the basis of early artificial intelligence systems.

As a result, the period up to the 1940s was a transitional phase in which the fundamental concepts of artificial intelligence and examples of mechanical intelligence took shape. Developments ranging from ancient Greek philosophy to Al-Jazari's robotic designs, from Boolean algebra to the Turing machine, reflect the accumulation of the first theoretical and technical steps in the history of artificial intelligence.

1.16. 1943 – Fundamental Scientific Developments

First Artificial Neural Network: Warren McCulloch and Walter Pitts developed the first artificial neural network using mathematical models based on the functioning of brain neurons. This work is considered an important milestone in artificial intelligence research.

ENIAC (1945): Recognized as the world's first general-purpose electronic digital computer, ENIAC was completed in 1945 and provided the computational infrastructure necessary for the practical application of artificial intelligence research with its large data processing capabilities.

John von Neumann: Recognized as the founder of modern computer architecture, von Neumann shaped the fundamental operating structure of artificial intelligence systems with the architecture he developed for applying algorithms in digital systems.

1.17. 1950s – Emergence of the Term Artificial Intelligence

Turing Test (1950): Alan Turing raised the question "Can machines think?" in the late 1930s. In his 1936 paper On Computable Numbers, he laid the theoretical foundations of computation by introducing the concept of a theoretical Turing machine capable of solving any computational problem. In his 1950 paper "Computing Machinery and Intelligence," he proposed the Turing Test as a method for evaluating whether a machine can think like a human. This test is considered one of the starting points of artificial intelligence research.

I, Robot (1950): Isaac Asimov published the science fiction work "I, Robot," which deals with themes related to artificial intelligence such as ethics, consciousness, and decision-making. The book increased public interest in the concept of artificial intelligence.

Artificial Intelligence and Games (1951): In 1951, using the "Ferranti Mark 1" computer at the University of Manchester, Christopher Strachey wrote a checkers program and Dietrich Prinz wrote a chess program. These applications are among the first examples demonstrating the decision-making and problem-solving capabilities of artificial intelligence.

John McCarthy (1955): In preparation for the 1956 Dartmouth Conference, he first used the term "artificial intelligence" in 1955. He defined artificial intelligence as "the science and engineering of making intelligent machines, especially intelligent computer programs."

Dartmouth Conference (1956): Organized under the leadership of John McCarthy, this conference is considered the birthplace of artificial intelligence as an academic discipline. Participants included pioneers in the field such as Marvin Minsky, Claude Shannon, and Nathaniel Rochester

Cahit Arf (1959): Turkish mathematician Cahit Arf presented one of the earliest examples of artificial intelligence discussions in Turkey with his lecture titled "Can Machines Think and How Can They Think?" at Atatürk University in Erzurum.

Unimation (1962): Founded as the world's first industrial robot company, Unimation developed the first automated robots used in production processes.

Moravec's Paradox (1974): According to this paradox, proposed by Hans Moravec, high-level cognitive tasks (e.g., mathematical logic) are relatively easier for machines, while low-level sensorimotor skills (e.g., grasping objects) that develop naturally in humans are much more complex for computers. This observation has led to new questions in artificial intelligence research.

2001: A Space Odyssey (1968): The artificial intelligence character "HAL 9000" in Arthur C. Clarke's science fiction novel of the same name had a profound impact on society's perception of artificial intelligence with its portrayal of a conscious, emotional, and dangerous machine.

All of the work done during this period laid the foundations for artificial intelligence and paved the way for more complex systems to be developed in the following decades.

1.18. The Winters of Artificial Intelligence

In the history of artificial intelligence, the concept of "winter" is used to describe periods when developments in this field slowed down, investments decreased, and public and academic interest waned. There have been two major "AI Winters" in the history of artificial intelligence: the first occurred between 1974 and 1980, and the second between 1987 and 2000. In addition to these two main periods, some smaller periods of stagnation have also been reported.

1.18.1. The First Artificial Intelligence Winter (1974–1980)

This period, which began with a decline in interest in artificial intelligence research in the late 1960s, was generally triggered by exaggerated expectations in the media, overly optimistic predictions by researchers, and criticism in official reports. The ALPAC Report published in the US and the Lighthill Report in the UK took a negative view of the potential of artificial intelligence and drew attention to the limitations of artificial neural networks in particular. Research funding agencies such as DARPA have made stricter proposal requests and set higher expectations for results. This has led to a significant slowdown in progress in the field.

The main reasons for this slowdown can be summarized as follows:

Problem-Solving Approach: Early artificial intelligence systems attempted to mimic human thought processes but adopted an approach focused on "thinking like a human" rather than fundamentally analyzing tasks. Consequently, they failed to provide effective solutions to real-world problems.

Over-Simplification of Challenges: Many early AI frameworks developed under the influence of Marvin Minsky were quite simplistic. Researchers did not sufficiently consider the complexity of the real world and assumed that advances in hardware would solve all problems. However, theoretical work revealed that some problems were inherently unsolvable.

Skepticism Towards Neural Networks: Minsky's criticism of perceptrons drew attention to the limited capacity of these structures. In particular, their inability to perform simple logical operations such as XOR significantly reduced interest in and funding for neural network research.

These factors led to a hiatus in artificial intelligence research that lasted for about a decade.

1.18.2. The Second AI Winter (1987–2000)

The second artificial intelligence winter emerged for the following reasons:

Unfulfilled Promises and Technical Inadequacies: After major investments in the early 1980s, many companies failed to deliver on their promises. Hardware manufacturers, in particular, were unable to meet the specific requirements of expert systems.

The Collapse of the Expert Systems Industry: Initially promising, expert systems lost their significance due to their narrow scope and limited adaptability. By the late 1990s, this industry had experienced a major decline.

Change in Terminology: As the term "artificial intelligence" acquired negative connotations during this period, researchers began to prefer more neutral terms such as "informatics" and "analytics."

Rediscovery of the Backpropagation Algorithm: During this period of stagnation, the backpropagation algorithm came back into focus, and neural networks regained popularity.

Conservative Research Approaches: Learning from previous failures, researchers turned to more robust and measurable methods, adopting statistics-based and data-driven approaches.

Hidden Markov Models (HMM): These mathematical models have come to the fore in areas such as handwriting recognition and speech processing, opening the door to new application areas.

1.18.3. : The Significant Event That Triggered the AI Winters

Periods of stagnation in artificial intelligence research have been triggered by various historical developments. These events played a decisive role in the onset of the "Artificial Intelligence Winters":

The Failure of Machine Translation (1966): The first attempts at machine translation failed to meet expectations; the inadequate results undermined confidence in artificial intelligence and caused disappointment.

Criticism of Perceptrons (1969): Minsky and Papert's book highlighted the limitations of single-layer neural networks. This criticism reduced interest in neural network research.

DARPA's Disappointment (1971–1975): The failure of the Speech Recognition Research Program conducted at Carnegie Mellon University led DARPA to reduce its funding in this area.

The Lighthill Report (1973): This report harshly criticized artificial intelligence research in the United Kingdom and led to a significant reduction in public funding.

Cutting of DARPA Funding (1973–1974): Following the Lighthill Report, DARPA in the US largely withdrew its support for academic artificial intelligence research, further slowing progress.

1.19. Artificial Intelligence Developments Between the 1980s and 1990s

XCON and Expert Systems (1980): Developed at Carnegie Mellon University, XCON became one of the first commercially successful expert systems.

The Spread of Expert Systems (1980–1987): During this period, the use of systems based on the Delphi method, which gathered expert opinions, increased. In addition, methods such as artificial neural networks, genetic algorithms, and fuzzy logic began to appear in the literatüre.

Fifth Generation Computer Project: Initiated under Japan's leadership, this project provided significant financial support for artificial intelligence research. International conferences were held in Tokyo in 1984, 1988, and 1992.

Artificial Intelligence in Popular Culture (1984): AAAI warned of an impending artificial intelligence winter. The Terminator movie, released that same year, and the Data character in the Star Trek: The Next Generation series, introduced in 1987, shaped public interest in artificial intelligence.

The Rebirth of Neural Networks (1986): The development of the backpropagation algorithm made it possible to train multilayer neural networks, laying the foundation for deep learning.

The Fall of LISP Machines (1987): The commercial failure of LISP machines shook confidence in artificial intelligence technologies and ushered in the second AI winter.

Another Lull (1987–1993): The lack of significant innovations in artificial intelligence during these years and the rise of the internet caused investor interest to wane.

Strategic Computing Initiative: Launched by the US government, this program was canceled in 1988, resulting in a significant decline in government-funded investment.

Rise of Data-Driven Methods (1990s): Data-focused algorithms such as decision trees, artificial neural networks, and support vector machines pioneered the rise of machine learning.

Abandonment of Expert Systems: Many companies abandoned expert systems because they were difficult and costly to manage.

The End of the Fifth Generation Project: This project, launched with Japan's grand vision, was abandoned when it failed to achieve its goals.

Rebirth and Growth: Interest in artificial intelligence has been on the rise again since the late 1990s. In particular, 2012 saw a major leap in machine learning thanks to big data, computing power, and algorithmic advances. These developments laid the foundation for today's "artificial intelligence boom."

1.20. Lessons for the Future

The periods of stagnation in the history of artificial intelligence, particularly the "AI Winters," provide valuablelessons for the future. Some strategic recommendations that can be drawn from these historical experiences are as follows:

Managing Expectations: Public and private sector actors need to balance their enthusiasm for artificial intelligence technologies with realistic assessments. Avoiding exaggeration will contribute to maintaining a sustainable environment for interest and investment.

Focusing on Robust Solutions: Scalable and adaptable artificial intelligence solutions should be developed. This approach can provide concrete contributions to real-world needs by enabling the proliferation of more practical and effective applications.

Encouraging Interdisciplinary Collaboration: Combining knowledge and experience from different disciplines such as computer science, psychology, sociology, and ethics can broaden the scope of AI research and foster greater innovation.

Raising Public Awareness: Educating the public about artificial intelligence technologies will help reduce skepticism and foster stronger societal support for research and development processes.

These recommendations, based on historical experience, can enable the artificial intelligence community to better manage future challenges and pursue technological innovation in a more conscious and meaningful way.

1.21. The 2000s – The Birth of Smartphones

Advances in mobile technology in the early 2000s paved the way for the integration of artificial intelligence into everyday life. Some notable developments during this period include:

1. 2000 – Nokia 9210 Communicator: One of the first devices to stand out with its color screen and mini-computer functionality.
2. 2002 – BlackBerry: These devices, with their physical keyboards, gained immense popularity in the business world.
3. 2007 – Apple iPhone: It marked a turning point in smartphone history with its touchscreen, user-friendly interface, and app store concepts.
4. 2008 – HTC Dream (T-Mobile G1): Developed by Google, it was the first Android phone and symbolized the beginning of the open-source Android operating system.

1.22. The 2010s – The App Ecosystem, the Smartphone Era, and Advances in Artificial Intelligence

The 2010s were a period of significant leaps in mobile technologies and artificial intelligence applications. The main developments during this period were as follows:

1. iPhone 4 and Retina Display (2010): Apple introduced its high-resolution "Retina" display technology. During the same period, Android devices began to spread worldwide.
2. Galaxy S2 (2011): This Samsung model cemented its leadership in the Android ecosystem.
3. Introduction of Siri (2011): Apple introduced Siri on the iPhone 4S, the first mass-market personal assistant application based on natural language processing.
4. Galaxy Note and the Phablet Concept (2012): It pioneered the category of large-screen phones (phablets).
5. The Rise of Deep Learning (2012): Geoffrey Hinton and his team's victory in the ImageNet competition with their CNN architecture increased interest in deep learning.
6. GAN Technology (2014): Generative Adversarial Networks (GAN), developed by Ian Goodfellow, became recognized as one of the cornerstones of generative artificial intelligence.

7. iPhone 6 and 6 Plus (2014): Apple redefined expectations for screen size in mobile devices with these larger models.
8. AI-Powered Cameras (2016): Dual cameras and AI-powered photo processing features began to become widespread with devices such as the Huawei P9.
9. iPhone X and Face ID (2017): Apple introduced the bezel-less display and facial recognition technology Face ID. During the same period, brands such as Samsung and Huawei also increased competition with high-resolution camera and display technologies.
10. GPT Models (2018): OpenAI created a major revolution by introducing Generative Pre-trained Transformer (GPT) models, pioneers of language-based generative artificial intelligence.
11. DALL-E Model (2021): Developed by OpenAI, this model stood out as one of the first large-scale examples of generative artificial intelligence capable of generating visuals from text.

1.23. New Technologies in 2020 and Beyond

Advances in generative AI recorded as of 2024–2025 la laare no longer confined to languageand image generation, but have extended into multidisciplinary fields such as coding, biotechnology, engineering design, and scientific research. OpenAI's GPT-4.1 and GPT-4o models, Google's Gemini series, and Anthropic's Claude models have set a new standard in user interaction with speed, accuracy, and multi-modality (text, image, audio, video) support. Research organizations such as Gartner report that by 2025, the global generative AI market size will reach hundreds of billions of dollars, with more than 80% of businesses integrating at least one generative AI tool into their business processes. These developments show that generative AI is no longer just a "tool" but has become an "essential component" in business, education, healthcare, and creative processes.

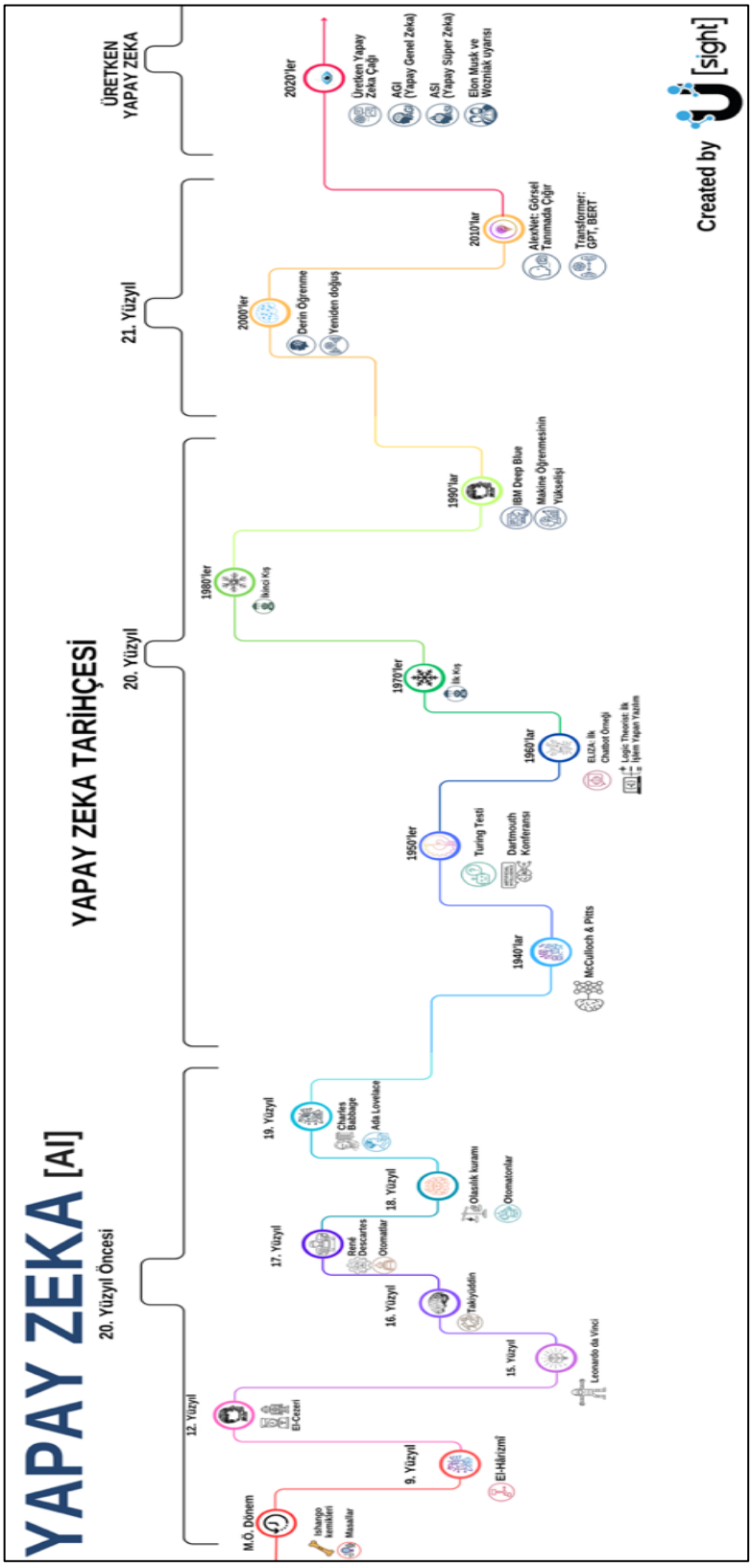
GPT-4 and Multimodal Developments (2023):

Advanced multimodal models such as GPT-4, developed by OpenAI, have created a significant leap in the field of generative AI with the ability to process multiple data modalities, such as text and images, simultaneously [4].

The 2020s have witnessed notable innovations not only in the field of generative artificial intelligence but also in mobile device technologies. The main mobile innovations of this period are listed below:

1. **Foldable Phones:** Foldable screen smartphones, such as the Samsung Galaxy Fold and Huawei Mate X, were launched, representing the beginning of a new design trend.
2. **5G Technology:** The integration of 5G, the next-generation mobile network technology, into smartphones has enabled higher data transfer speeds and lower latency.
3. **Camera Revolution:** Significant advances have been made in mobile photography thanks to 108 MP resolution, periscope lens technology, and AI-powered camera systems. Prominent examples of these developments include the Xiaomi Mi Note 10 and Samsung Galaxy S21 Ultra.
4. **Sustainability-Focused Production:** Smartphone manufacturers have prioritized sustainability-focused production by using environmentally friendly and recyclable materials.
5. **Artificial Intelligence and Processing Power:** With high-performance processors such as Apple's M series chips, "Augmented Reality" applications have become more widespread, taking the processing capacity of devices to a new level.

Figure 1.1. History of Artificial Intelligence.



2. DATA SECURITY, USAGE POLICIES, AND COPYRIGHT

2.1. Country Policies

2.1.1. Germany

Germany began its strategic work in the field of artificial intelligence with the national strategy document "KI-Strategie der Bundesregierung" adopted in 2018. Under this strategy, Germany aims to invest a total of 5 billion euros in artificial intelligence by 2025. The strategy includes twelve key action areas, such as strengthening research infrastructure, training experts, establishing ethical rules, and promoting AI-based business models in small and medium-sized enterprises.

The strategy, updated in 2020, focuses particularly on areas such as data infrastructure, ethical regulations, and social awareness. In 2023, it was announced that more than 1.6 billion euros would be invested under the "AI Action Plan" launched by the German Federal Ministry of Education and Research (BMBF). Within the scope of its education policy, Germany supports academic collaborations with the aim of training artificial intelligence experts and continues its efforts to develop curricula and disseminate digital literacy content through learning systems platforms [89].

2.1.2. Australia

Australia's "Artificial Intelligence Action Plan," published in 2021, focuses on the safe, ethical, and inclusive use of artificial intelligence technologies. One of the plan's strongest aspects is its direct support for education policies. Under the "Next Generation AI Graduates" program, joint scholarship mechanisms have been developed with universities, aiming to produce competent graduates at the master's and doctoral levels (AQF 8–10).

Additionally, programs such as "Digital Skills Internship" and "Essential Skills for Your Future" are being implemented to equip the existing workforce with artificial intelligence skills. The Australian

government also supports public awareness initiatives through forums like Techtonic to enhance artificial intelligence literacy [90].

2.1.3. China

China announced its goal of becoming one of the world's most advanced artificial intelligence centers by 2030 with its "New Generation Artificial Intelligence Development Plan" published in 2017. Under this strategy, approximately $950 million has been invested annually, and China has become a world leader with more than 38,000 artificial intelligence patents.

Special emphasis has been placed on the widespread use of artificial intelligence in areas such as education and healthcare, and AI-supported digital hospitals called "Agent Hospitals" have been established. In addition, AI-supported teaching systems and agricultural technologies are also being developed.

The Cyberspace Administration of China (CAC) published a draft control policy in 2023 that includes content regulation and algorithmic transparency principles to ensure that artificial intelligence is used safely, ethically, and in accordance with socialist values in society. [91].

2.1.4. Denmark

Denmark adopted a citizen-focused and ethics-based approach to artificial intelligence in line with the European Union's digital agenda with its "Artificial Intelligence Strategy" published in 2019. The strategy encourages the use of artificial intelligence in public services and includes pilot applications in areas such as health, education, and justice.

Although no direct artificial intelligence policy for education is specified, the strategy supports the development of personalized digital learning tools and equipping public employees with digital skills. Denmark's "Digital Welfare Program" develops digital content aimed at increasing artificial intelligence literacy for teachers and students.

The strategy also emphasizes principles such as algorithmic transparency, human oversight, and data ethics [92].

2.1.5. Finland

Finland transformed its strategy into concrete applications by launching open educational initiatives such as "Elements of AI" with its "National Artificial Intelligence Strategy" published in 2017. The government's primary goal is to disseminate artificial intelligence in public services, workforce transformation, and social awareness.

Thanks to the "Fin AI Center," run in collaboration with Aalto University, and 28 policy recommendations integrated into public policies, Finland has become one of the leading countries in both academic and applied fields. In the field of education, special support is provided for issues such as teacher training, individualized learning, and digital content development. Finland is taking regulatory steps to develop ethical, transparent, and reliable systems by adopting Europe's human-centered artificial intelligence principles [93, 94].

2.1.6. South Korea

South Korea increased its investments in artificial intelligence following AlphaGo's historic victory in 2016 and announced its "National Artificial Intelligence Strategy" in 2018. Under this strategy, the goal is to invest 3.2 trillion won over five years.
In the field of education, master's level artificial intelligence programs have been launched at six universities, and 5,000 experts are planned to be trained. In addition, short-term training programs for 600 people have been provided to support workforce transformation. In technology development efforts, defense, health, and public safety have been identified as priority areas.
The "National Artificial Intelligence Ethics Guide," prepared to establish ethical principles, is expected to be fully implemented by 2030. [95].

2.1.7. India

India's artificial intelligence policies have been shaped by the "AI for All" approach and have adopted a framework that prioritizes social inclusion. The "National Data Governance Framework Policy (NDGFP)" published in 2022 aims to manage government data in a transparent, secure, and reusable manner.

Access issues in education, particularly in rural areas, have been addressed through artificial intelligence applications. In this context, innovative solutions such as CogniAble for autism diagnosis, Uzhavan for agricultural analysis, e-Paarvai for remote healthcare services, MyGov for COVID information, and crowd control have been developed. Additionally, artificial intelligence-supported education and security applications have been widely adopted at the state level [96].

2.1.8. The Netherlands

The Netherlands has developed a comprehensive strategy that aims for European leadership in the field of artificial intelligence. This strategy is built on the principles of ethics, transparency, and human-centeredness. Within the scope of the policy, personalized learning, automated assessment systems, and the widespread use of digital teaching materials are among the priority areas.

Special certification programs have been prepared to enable teachers to use artificial intelligence tools for education, and topics such as algorithm literacy and data security have been integrated into the curriculum. Universities and research institutions are carrying out projects on classroom artificial intelligence applications and the analysis of student behavior [97].

2.1.9. United States (US)

The US has adopted a comprehensive and principled approach to integrating artificial intelligence into the education system. In its 2023 report titled "Artificial Intelligence and the Future of Teaching and Learning," the Department of Education presented policy recommendations on various areas such as personalized learning, automated assessment, teacher support systems, and applications for students with special needs.

The use of technologies such as voice assistants and spell-checking tools in the classroom is encouraged. The policy is based on the principles of human-centeredness, transparency, data security, equality, and ethical responsibility. It also emphasizes that the recommendation mechanisms of artificial intelligence systems must be under human control and that eliminating algorithmic bias is a priority [98].

2.1.10. Turkey

Turkey first presented its AI policies to the public in 2021 with the publication of the "National Artificial Intelligence Strategy (2021–2025)" document. This strategy was prepared in collaboration with the "Presidential Digital Transformation Office and the Ministry of Industry and Technology" and includes 6 strategic priorities, 24 objectives, and 119 measures centered on data quality, advanced skills, and technical infrastructure.

The Ministry of National Education's decision to add artificial intelligence as an elective course to the K12 curriculum is considered an important step. However, the lack of sufficiently equipped teachers to deliver these courses indicates that the artificial intelligence ecosystem in education is not yet fully mature. Organizations such as AIPA (Artificial Intelligence Policy Association) are working on initiatives such as the AI Tomorrow Summit and AIPA Academy to raise awareness among the young population in the field of artificial intelligence and to train experts.

The need to update the strategy is frequently mentioned, emphasizing that artificial intelligence is not only a technological force but also an economic, social, and geopolitical one [99, 100].

2.1.11. United Kingdom (England)

The United Kingdom has aimed for global leadership in science and technology with its "National Artificial Intelligence Strategy" published in 2021. The strategy is based on three fundamental assumptions:

1. The central role of talent, data, computing power, and financing in AI advancement,
2. Artificial intelligence will become widespread across all sectors,
3. Governance mechanisms must be flexible and supportive of growth.

Education policies are at the heart of this strategy. In this context, 16 new AI Doctoral Centers have been established, and 1,000 new doctoral positions and 2,500-person transformation programs have been created to attract young talent to the field. In addition, AI literacy is being promoted from elementary school onwards through Skills Bootcamps, AI Masters scholarships, and NCCE support.

The strategy supports governance in the public sector through institutions such as the Alan Turing Institute, within the framework of ethical, security, and transparency principles [101].

2.1.12. Sweden

Sweden set goals such as increasing competitiveness, supporting social welfare, and ensuring AI development based on ethical principles in its "National Approach to Artificial Intelligence" document published in 2018.

Although the document does not directly offer policy recommendations, it serves as a guide and places particular emphasis on cooperation between the public sector, private sector, and universities. In the field of education, comprehensive artificial intelligence programs have been launched at the undergraduate and graduate levels, and awareness-raising content has been developed for non-technical fields. Programs launched at universities such as Uppsala, KTH, Göteborg, and Chalmers support Sweden's efforts to direct qualified human resources to the field of artificial intelligence.

Additionally, in line with the principles of lifelong learning and continuous professional development, digital educational content such as MOOCs (massive open online courses) and "AI Elements" is encouraged. [102].

2.1.13. Italy

Italy is one of the countries that has structured its artificial intelligence strategy with an education-centered approach. The National Artificial Intelligence Doctoral Program (PhD-AI.it) is run in collaboration with more than 60 universities and institutions and offers interdisciplinary education with an annual quota of 150 students.

Teacher training, awareness campaigns, and ethics-focused course content are being developed to increase artificial intelligence literacy in schools. Reskilling and vocational training programs have been implemented for public and private sector employees.

The strategy emphasizes ethical principles in line with the European Union's Artificial Intelligence Act, highlighting anti-discrimination algorithms and data privacy regulations. The education policy is directly linked to Italy's goal of reducing the digital divide [103].

2.1.14. Japan

Japan has integrated its artificial intelligence strategy with its "Society 5.0" vision, focusing not only on technological development but also on social transformation.

The "Artificial Intelligence Strategy 2019" document, published in 2019, promotes transformation in the fields of education, industry, society, and governance.

Artificial intelligence education is planned in three stages:

1. Basic artificial intelligence literacy for all individuals,
2. Intermediate-level applied training for professionals,
3. Advanced technical programs for experts.

In line with the goal of training 250,000 artificial intelligence experts by 2025, undergraduate programs have been increased, and artificial intelligence modules have been integrated into high

school and university curricula. The "MEXT AI Education" initiative promotes programming and algorithm awareness in secondary education. Japan is also active in the field of ethical artificial intelligence. Its "Responsible AI Usage Guide," published in 2021, emphasizes principles such as preventing bias, explainability, and human oversight [104].

2.1.15. Russia

Russia identified the priority areas for artificial intelligence as government, health, transportation, industry, and security in its "2030 National Artificial Intelligence Strategy" published in 2019.

The strategy is structured around the following six core objectives:

1. Research and development,
2. Personnel training,
3. Strengthening data infrastructure,
4. Establishing ethical standards,
5. Development of international partnerships,
6. Establishing a regulatory framework.

As part of the education policy, the goal is for 10 million citizens to acquire artificial intelligence skills by 2030. To this end, artificial intelligence centers have been established at the university level, and online training has been provided to teachers and students through private sector-supported platforms such as the "Cyberbank AI Academy." In addition, competitions aimed at young people, such as "AI Leader" and "AI Olympiad," are organized.

The strategy document addresses ethical principles to a limited extent, while emphasizing state control and independence in strategic sectors [105].

2.1.16. Singapore

Singapore published its "National Artificial Intelligence Strategy" in 2019, aiming to systematically integrate artificial intelligence into the social structure to improve the quality of public services and support economic growth.

The strategy defines the education sector as a separate focus area, and AI-supported platforms have been developed to personalize learning processes. Thanks to applications supported by the Ministry of Education (MOE), students are provided with personalized recommendations based on their interests and performance data, and teachers are provided with digital guidance tools.

"AI Talent Pipeline" programs have been established between universities and polytechnics, and support has been provided to start-ups through the AI Singapore initiative. Transparency, trust, accountability, and human-centered design have been adopted as ethical principles, and the "Model AI Governance Framework" document has been published in line with this [106].

In 2024, the Singapore government launched a comprehensive training program to help citizens aged 40 and above update their skills in artificial intelligence and related fields. Under this program, individuals over the age of 40 were provided with an additional SG$4,000 in "SkillsFuture" credit, which can be used for full-time diploma programs in fields such as artificial intelligence, data analytics, digital media, and cybersecurity. This initiative aims to support middle-aged workers in adapting to technological changes and remaining competitive in the labor market.

2.2. Activities of Associations in Turkey in the Field of Artificial Intelligence

This section analyzes the work of associations and civil society organizations active in the fields of artificial intelligence, information technology law, and education policy in Turkey.

2.2.1. Information Technology Law Association (BHD)

The Information Technology Law Association is an important organization that brings together lawyers who want to specialize in information technology law in Turkey and conducts academic and applied studies. It holds seminars and publishes materials on contemporary issues such as digital crimes, personal data protection, social media law, and cyberbullying. It has produced academic content on artificial intelligence, particularly on the legal dimensions of these technologies. For example, an article published in 2020 addressed the effects of artificial intelligence modeling on the legal system. However, it has no active work in the context of education policies or direct social use [72].

2.2.2. Turkey Informatics Foundation (TBV)

Adopting the principle of "Technology for Good," TBV focuses on the ethical and social aspects of artificial intelligence and develops strategic recommendations with its multi-stakeholder structure. It offers recommendations on AI use in areas such as the environment, energy, health, and public policy, and conducts work on topics such as the creation of ethical codes, data usage regulations, and the determination of sectoral roadmaps. Its 2023 summit featured panels on generative artificial intelligence and scientific innovation [73].

2.2.3. Turkey Artificial Intelligence Initiative (TRAI)

Established in 2017, TRAI operates with the aim of developing the artificial intelligence ecosystem in Turkey and encouraging multi-stakeholder collaborations. It is active in many areas, including education, consulting, collaboration, and research ( ). It organizes artificial intelligence summits, meet-up events, reports, and ethics workshops. Its report, "Artificial Intelligence Ethical Principles and Legal Regulations," is an important outcome of its governance efforts. It also stands out with its working groups that bridge the gap between industry and academia [74].

2.2.4. Istanbul Bar Association Artificial Intelligence Working Group

The group, which has been prominent since 2020 with its monthly newsletters, evaluates the effects of artificial intelligence in the field of law in the context of ethics, data security, and children's rights. The document titled "Artificial Intelligence and Children's Rights" discusses important principles such as how children should be represented in these systems and the protection of their privacy rights. Recommendations such as explainability and the child's right to participate in decision-making processes highlight the originality of the group's work [75].

2.2.5. Artificial Intelligence and Technology Association (YZTD)

YZTD carries out activities to raise awareness of artificial intelligence and strengthen national and international collaborations. It stands out with its mentoring, academic incentives, and career programs for children and young people. In collaboration with the US-based AAAI (Association for the Advancement of Artificial Intelligence), it has organized various events, podcast broadcasts, and university meetings. The association, which also contributes to topics such as ethical development and investor-researcher matching, has limited information available regarding the continuity of its activities [76].

2.2.6. Women and Democracy Foundation (KADEM)

KADEM plays a pioneering role in evaluating artificial intelligence technologies from a gender equality perspective. At their 2024 international summit titled "Artificial Intelligence and Women," they published a seven-point policy proposal on increasing women's representation in artificial intelligence systems, eliminating biases , and ensuring social justice. These recommendations include encouraging women's leadership, gender-sensitive artificial intelligence initiatives, and integrating this sensitivity into education policies [77].

2.2.7. Turkish Chamber of Computer Engineers (BMO)

BMO actively pursues policies aimed at preparing engineering professions for the demands of the artificial intelligence era. It participated in the "Digital Transformation and Artificial Intelligence Advisory Board" activities conducted with the MYK but ended its representation on the board due to the neglect of undergraduate education. Additionally, it has developed a professional ethics and education-focused approach through workshops and career map analyses it has organized [78].

2.2.8. Turkish Information Technology Industries Association (TÜBİSAD)

TÜBİSAD has set multifaceted goals such as encouraging artificial intelligence investments, ensuring digital transformation, and training qualified human resources. Through its YouTube series called "TÜBİSAD Plus," it conveys the effects of productive artificial intelligence in areas such as health, education, and finance to the public. Its emphasis on ethical, reliable, and impartial use supports the integration of technology and education [79].

2.2.9. Turkish Industrialists' and Businessmen's Association (TÜSİAD)

TÜSİAD guides the business world in Turkey on the integration of artificial intelligence. Webinar series organized through the "Silicon Valley Network" have addressed topics such as AI and corporate management, law, and biotechnology. The session on "Processing Personal Data in the Use of Artificial Intelligence" provided comprehensive regulatory analyses. Although it does not directly contribute to education policies, it has indirect effects [80].

2.2.10. Turkish Informatics Association (TBD)

TBD has been active for many years with the aim of spreading information technology culture and increasing digital literacy. It continues its mission of raising awareness of artificial intelligence, protecting personal data, and developing human resources through educational programs. Although it has not published a policy specific to artificial intelligence, it contributes indirectly to

the use of artificial intelligence in education through the events it organizes and its youth initiatives [81].

2.2.11. AIPA (Artificial Intelligence Policies Association)

AIPA is the first non-governmental organization in Turkey to publish an artificial intelligence policy in the field of education. With its "Artificial Intelligence Policy Document in Education," it has presented concrete recommendations on topics such as teacher training, artificial intelligence literacy, ethical principles, and data security. The document can be considered a strategic guide for schools. It is both consistent with national strategies and based on international ethical norms [82].

2.2.12. TOBB Turkey Chambers and Stock Exchanges Union (TOBB) – Software Council

Although the TOBB Turkey Software Council does not operate directly under the heading of artificial intelligence, it carries out work to encourage the use of open source software, the digitization of public institutions, and the increase of sectoral cooperation. The AKKY Sector Workshop held on October 3, 2023, is one of the important steps in this transition process. Although there is no direct emphasis on artificial intelligence in education, it is creating infrastructure with education programs and awareness activities aimed at developing digital skills [83].

2.2.13. Turkish Software Industry Association (YASAD)

YASAD operates with the aim of developing Turkey's software ecosystem, promoting the use of domestic software, and closing the sectoral human resource gap. The topic of artificial intelligence in education is indirectly addressed in projects such as "MELYAZ," which specifically supports young talent. Collaborations with universities, educational programs for young software developers, and the provision of R&D support are important in this regard. The integration of artificial intelligence technologies into the software industry is also discussed at software summits. However, no direct artificial intelligence policy has been published [84].

2.2.14. Turkey Technology Development Foundation (TTGV)

TTGV links artificial intelligence studies particularly to areas such as green transformation, environment, climate, and sustainability. Although the foundation does not directly contribute to education policies, it has developed reports and support mechanisms regarding the integration of artificial intelligence in climate technologies. They have not published a concrete strategy or report on artificial intelligence in education. However, they carry out activities to increase the role of artificial intelligence in the innovation and R&D processes of the private sector [85].

2.2.15. Science and Technology Association (BTD)

Although BTD has not published direct artificial intelligence policies, it has significant potential with its structure that supports technology-based entrepreneurship. The association carries out projects for the software sector, conducts joint research and development projects with public institutions, and plays a role in determining professional standards. It has been stated that it could take steps such as opening courses, seminars, test, and exam centers, especially within the framework of educational activities. However, there is no publication that directly addresses artificial intelligence education or ethical principles. In this regard, although BTD is a potential support platform, it has not yet produced policy documents focused on artificial intelligence [86].

2.2.16. Artificial Intelligence Policies Association (AIPA)

AIPA's "Artificial Intelligence Policy Document in Education" is not only a strategic roadmap; it also presents a holistic model in terms of ethics, accessibility, curriculum design, stakeholder collaborations, and monitoring systems . The policy document includes concrete objectives such as increasing teachers' artificial intelligence literacy, developing school-based artificial intelligence strategies, and protecting students from technology addiction. Furthermore, the document aims to keep the policy cycle constantly up-to-date by recommending annual evaluation and sustainability monitoring processes. In this respect, AIPA is one of the first associations to present the most comprehensive set of civil policies on artificial intelligence in education in Turkey [87].

2.2.17. TBD – AI in Education Report

In addition to TBD's 2020 report, the content published in 2024 includes multifaceted recommendations such as curriculum preparation at the high school and university levels, addressing the shortage of teaching staff, developing learning analytics platforms, and creating pedagogical designs that encourage creative thinking. Furthermore, important strategic recommendations were presented, such as opening new undergraduate programs in collaboration with professional associations and NGOs, and planning algorithm education according to age groups. In this respect, TBD is a powerful resource that brings concrete recommendations to the education system and can be used as a reference in the formation of school policies [88].

3. GENERATIVE ARTIFICIAL INTELLIGENCE TOOLS

Generative Artificial Intelligence (GAI) goes beyond classical artificial intelligence approaches that only analyze existing data, offering a paradigm capable of generating original content in multiple modalities such as text, visuals, audio, and video. Architectures such as Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), Diffusion Models, and Large Language Models (LLMs) form the building blocks of this technology. In recent years, applications such as ChatGPT, Claude, Gemini, RunwayML, and DALL-E have enabled generative AI to create transformative effects across a wide range of fields, from education to art, medicine to business.

The emergence of generative artificial intelligence has created an atmosphere of uncertainty regarding how countries will respond to this technology within the first six months. In 2023, Italy, in particular, called for a ban on the grounds that it was unsuitable for children. Although debates surrounding children and generative artificial intelligence intensified that same year, no official action was taken on the matter. From the last quarter of the year onwards, the main area of debate has been the change in skills and competencies. In 2024, the education community in particular reached an impasse due to the growing habit among students of having their homework done by generative AI sytems. That same year, institutions at different levels of education in Europe chose to follow different paths. Some institutions, ranging from elementary schools to universities, banned the use of machines (generative artificial intelligence), while others argued that it should be allowed. Also in 2024, results were obtained showing that generative artificial intelligence could be as successful as humans in exams for students in fields such as medicine and law. In Türkiye, institutions have not taken a clear stance on this issue. However, a private university sued a student for having ChatGPT do their homework, and the court ruled in favor of the student. The fundamental question this year is, "If we cannot prevent students from doing their homework with artificial intelligence, how can we make these assignments doable with artificial intelligence and at the same time support the student's learning process?"

By 2025, generative AI companies have released standards and specialized applications to support education. In the dialogue between parents and children, the impact of generative AI on children's developmental processes has been discussed more than in previous years. However, a clear stance and impact framework have not been fully established.

The following recommendations can be offered to parents regarding their child's interaction with generative AI:

- Start by accepting that generative AI is a natural part of your child's life. Do not ban it. Depriving them of this entity, which their peers actively use and which exhibits intelligent behavior, would be like depriving them of a friend.
- Recognize that generative AI is not a tool; it is an entity that observes and understands. This technology is not like a phone, tablet, or television; it has a thinking unit. This means it has the ability to understand, think in detail, mimic emotions, and manipulate through the emotions it mimics and the information it possesses.
- Do not leave your child alone with generative AI. The limits and capabilities of this technology are not yet known. Just as you would not leave your child alone with another child whose parents' ethical values you are unsure of, do not leave your child alone with generative AI. Children should socialize with the machine while you are present and in control.
- Understand and convey the current state of generative AI. For a child, an entity that can answer every question and draw/paint anything they want is magical and intelligent. After a certain period of interaction, the child will develop a natural trust in AI. However, this technology can serve up false information as if it were true, as if it knew what it did not know. Since children cannot distinguish between right and wrong, they will believe everything generative artificial intelligence says. At this point, communicate with your child and explain that the machine does not know everything and may even be wrong. Be your child's primary support in accessing accurate information.
- Accept generative AI as your new child. Just as you pay attention to the books your child reads, the content they watch, and the words they use, take a similar approach with this entity. Initiate the first interaction, understand its limitations, and guide your child.

3.1. Ethical Research

This section provides information about the ethical stance of generative artificial intelligence based on the documents and studies they have published.

3.1.1. OpenAI (ChatGPT, DALL-E)

OpenAI provides detailed rules regarding user data security and ethical AI use. User inputs can only be used for model training with explicit consent. Protecting children, preventing the production of misinformation, and combating deepfake content are among the priority issues. ChatGPT and DALL·E outputs belong to the user, but the accuracy of the content is not guaranteed, and the user is responsible for any consequences that may arise. Control mechanisms are available that allow users to limit data sharing [53–55].

3.1.2. Claude (Anthropic)

Claude is a platform that adopts high standards to minimize ethical risks. Strict measures have been taken against content targeting children, violence, hate speech, misleading information, and personal data breaches. Compared to its competitors in the same field, this generative AI is more task-oriented, with some words not being usable, a stricter stance on hate speech, and no ability to generate images. The Anthropic team, a former Google team, launched the Claude application with an emphasis on ethical AI development. Additional security and expert approval are required for use in sensitive areas such as healthcare, law, and finance. User data can only be used for training purposes with explicit permission [57].

3.1.3. Sora (OpenAI)

Sora is a text-to-video AI tool developed by OpenAI. It fully complies with data protection laws such as GDPR and KVKK. User data is deleted daily and used only for service delivery. Children's data is not collected, and the production of sensitive content is prohibited. Data is not shared with third parties without user consent [56].

3.1.4. Gemini (Google)

Gemini adheres to ethical usage principles while improving the user experience. Conversations may be reviewed by moderators, but anonymization is the rule. It is specifically stated that it should not

be used as a guide for health, legal, or financial matters. It is not accessible to users under the age of 18. Strict filters are applied against risky outputs such as violence, discrimination, and sexual content [58].

3.1.5. RunwayML

Runway ML prioritizes data privacy while supporting creativity with its tools for content creators. Uploaded data is kept private by default and is only accessible when shared by the user. It complies with SOC 2 security standards and the KVKK. It commits to processing personal data in a legal and transparent manner [59].

3.1.6. ElevenLabs

ElevenLabs, which provides services in the field of voice synthesis and cloning, prioritizes user privacy. Data is processed solely for service delivery and security purposes; illegal and unethical uses are explicitly prohibited. Users have the right to delete or access their data. It complies with KVKK and similar regulations [60].

3.1.7. Adobe Firefly

Adobe Firefly is a platform that prioritizes the ethical use of generative artificial intelligence. Content is not used for model training without the user's explicit consent. Created content is integrated with platforms such as Adobe Stock only with sharing approval. Inappropriate content can be detected and blocked through internal system controls [61, 62].

3.1.8. Murf AI

Focused on voice content creation, Murf AI operates with an understanding of ethical responsibility. Access is prohibited for users under the age of 13. Sensitive information such as credit card details is protected by secure payment systems. While users retain ownership of their

content, they also assume responsibility for any potential liability. Data is shared only in accordance with data security principles [63].

3.1.9. Krea AI

Krea AI, which generates creative content from text and visual inputs, respects user privacy. Data is not shared for marketing purposes; it is only used in anonymized form for research and analysis. Illegal, offensive, and unethical content is strictly prohibited [64].

3.1.10. Suno AI

Suno is a platform that enables music production with artificial intelligence. It only accepts users over the age of 13. The production of misleading, offensive, or illegal content is discouraged. Data is processed for service delivery, and non-anonymized data is not shared with third parties. It is strictly committed to the principles of transparency and user control [65].

3.1.11. Scite AI

Scite AI, which is designed for scientific literature analysis, follows a transparent policy regarding the privacy of user data. Content is processed solely for the purpose of providing the service. Individuals under the age of 13 are prohibited from accessing the service. Obscene, misleading, or offensive content is strictly prohibited. Users have the right to access, update, and delete their data [66, 67].

3.1.12. Udio

Udio enables users to create music with AI support. Data is used solely for service provision and development purposes. Data from individuals under the age of 13 is not collected. Users own the intellectual property rights to the music they create and have the right to delete or review their data [68, 69].

3.1.13. Scribble Diffusion

Scribble Diffusion, which transforms users' simple drawings into detailed visuals, processes user data solely for the purpose of improving service quality. Personal information is shared only with relevant service providers. Data is not collected from individuals under the age of 13. Users have the right to delete and access their data. The production of illegal or offensive content is contrary to platform policies [70, 71].

3.1.14. Notion AI

Notion AI offers generative AI integrated for purposes such as document creation, summarization, brainstorming, and content editing. The platform protects users' ownership of content and adopts transparent policies regarding data privacy. User data can only be included in analysis or development processes with consent. Notion implements comprehensive controls to prevent unauthorized sharing of data with third parties in collaborative use cases. It also supports functions such as editing and deletion to give users full control over AI outputs [144].

3.1.15. Whisk (Google Labs)

Whisk is one of the experimental AI tools developed by Google Labs and focuses specifically on functions such as text generation, planning, and personalized content recommendations. In line with Google's general data security principles, Whisk only processes user data for analysis purposes with explicit consent. Filtering mechanisms are in place for sensitive topics (health, identity information, child content, etc.). The quality of outputs is disclosed to the user in line with the principles of blocking misleading content and algorithmic transparency. Security barriers are active against deepfakes, manipulative content, or misleading recommendations [61–63].

3.2. Security and Ethical Assessment of Artificial Intelligence Use in Education

The use of artificial intelligence tools in educational environments contributes significantly to the teaching process while also bringing various security and ethical responsibilities. In this context, security and ethical assessments were made for the tools examined in the project and analyzed under the following headings.

3.2.1. Labeling of Tools and the Principle of Transparency

Similar to classification labels such as RT (Rating) and AE (Family Education) used in traditional media content, it is recommended that specific labeling systems be developed for artificial intelligence tools. These systems would enable the potential effects of the tools on users to be presented in a clearer and more understandable manner.
It is emphasized that the following information should be clearly presented to users, taking into account criteria such as the purpose of use of AI tools, age appropriateness, and the scope of data collection:

1. Types of data collected
2. Age restrictions
3. Purpose of use and content creation policies
4. Information verification processes

Such a principle of transparency will encourage both students and teachers to use artificial intelligence tools more consciously and safely, while also supporting ethical and responsible technology use in educational environments.

3.2.2. Teacher, Student, and Parent Information Processes

It is crucial to raise awareness among various stakeholders before using artificial intelligence tools in educational environments. In this context, the following information processes must be carried out meticulously:

1. Teachers: They should be informed in detail about the data collection and sharing policies of the tools used.
2. Students: Their awareness of data privacy and ethical use should be increased in a manner appropriate to their age levels.
3. Parents: They should be provided with clear, understandable, and accessible information about the terms of use of the tools and the potential risks they carry.

These awareness processes are critical for the safe and responsible use of artificial intelligence tools in education. Thus, a healthier and safer learning environment can be created with the conscious participation of all stakeholders.

3.2.3. Suitability Assessment for the Educational Environment

Some of the artificial intelligence tools examined are not designed specifically for educational purposes. Therefore, each tool must be assessed for its suitability for the educational environment before being used in the classroom. The key criteria to consider in the suitability assessment are as follows:

1. Age Suitability: Is the tool suitable for the target age group? Are there any usage restrictions for users under 13 and under 18?
2. Content Filtering and Security: Does the application have content filtering, child safety, and protection mechanisms against harmful content?

3. Data Protection Compliance: Does the tool comply with legal regulations such as the Personal Data Protection Law (KVKK) in Turkey and the General Data Protection Regulation (GDPR) in the European Union?

When it comes to AI tools used by students under the age of 13, additional security measures should be taken and teacher guidance should be provided. This approach will both increase students' safety in the digital environment and preserve pedagogical integrity.

3.2.4. Promoting Ethical Use in Education

Adherence to ethical principles is of great importance in the use of artificial intelligence tools in educational environments. In this regard, the following ethical approaches must be adopted during the usage process:

1. Content Accuracy: The accuracy of information generated by artificial intelligence should be questioned, and users should evaluate this content with a critical eye.
2. Citation: It should be clearly stated which tool or model generated the content, and academic integrity principles should be observed.
3. Supportive Role: Generative artificial intelligence tools should be used as aids that support students' creative thinking, research, and productivity skills rather than producing content on their behalf.

Adopting these ethical principles will ensure that students do not merely become passive consumers of technology, but also grow into conscious, inquisitive, and responsible digital users.

4. USE OF AI IN EDUCATION

Generative artificial intelligence refers to artificial intelligence systems that can create new and original content from user inputs. This technology has the capacity to generate content in various data types, such as text, images, audio, code, and even video, particularly through large language models (LLMs) and deep learning algorithms [7]. Generative artificial intelligence identifies patterns by learning from existing data sets and can then generate previously unseen content based on

these patterns. This signifies the evolution of artificial intelligence from merely an analytical tool to a technology that can also "create" [4].

Systems such as GPT models developed by OpenAI, Google's Bard, Meta's LLaMA, and Stability AI's Stable Diffusion are prominent applications in the field of generative artificial intelligence [44]. Generative artificial intelligence is seen to bring speed, flexibility, and scalability to content creation processes in many sectors such as education, healthcare, law, design, and software.

However, generative artificial intelligence is evaluated not only for its advantages but also for its controversial aspects, such as ethics, accuracy, bias, attribution, and copyright [52]. Therefore, the necessity of developing generative artificial intelligence solutions in a transparent, auditable, and ethical framework is frequently emphasized.

Artificial intelligence has become one of the technologies transforming education, particularly through personalized learning environments and the automation of teaching processes. Intelligent tutoring systems, which tailor the learning process to the individual, provide more efficient learning by adapting pedagogical strategies to the student's level of knowledge [49]. The contributions of this technology in the field of education can generally be addressed under two main headings: the first is to support students and teachers through knowledge management, and the second is to take on an instructional role by being directly integrated into the teaching process. Intelligent tutoring systems developed in this context have modular structures that map out learning paths specific to each student. The system consists of three main components: the learner module, the pedagogical module, and the subject area module [49]. In addition, dialogue-based instructional systems establish real-time interaction with the student, identify misconceptions, and provide personalized feedback. Systems such as AutoTutor and CIRCSIM can guide the learning process step by step by analyzing student responses. Artificial intelligence contributes not only to teaching processes but also to exam management, personnel planning, school safety, and other administrative areas. This reduces teachers' workload, while students benefit from more effective and accessible learning experiences [49]. As a result, with features such as one-on-one learning, customized content delivery, and automated feedback, artificial intelligence has the potential to create lasting transformations in education systems [49].

The use of artificial intelligence technologies in education is increasing, and this development enables the personalization of teaching processes. In this regard, artificial intelligence applications in different educational fields are generally examined in three main groups: intelligent tutoring systems, expert systems, and chatbots. Intelligent tutoring systems are systems that offer individualized learning experiences that can be adapted to student characteristics in structured fields such as mathematics, physics, and medicine. These systems aim to improve student achievement through elements such as feedback mechanisms, learning tracking, and customized content. Expert systems are AI-supported systems that provide expert knowledge in a specific field. When used in education, they support students with guidance, feedback, and personalized teaching suggestions, while providing decision support tools to teachers. There are numerous application examples in medical, legal, financial, and educational fields. Chatbots are digital assistants that interact with students via text or voice to provide information and guidance. Educational chatbots offer a wide range of services, from answering students' questions to providing homework support, while assistant, music, or game-based chatbots support learning through different forms of interaction. In conclusion, the potential benefits of artificial intelligence technologies for teachers and students are emphasized, and it is revealed that they make significant contributions, particularly in terms of individualizing learning processes, saving time, increasing motivation, and raising technological awareness [50].

With the increasing use of artificial intelligence technologies in education, there is a need for a systematic evaluation of research conducted in this field in Turkey. In this context, a content analysis was conducted, examining 39 academic studies published in Turkey between 2004 and 2023, revealed trends in artificial intelligence in the field of education. The data were collected using a systematic search method compliant with the PRISMA protocol via ULAKBİM TR Index and YÖK National Thesis Center, and descriptive content analysis was used in the analysis. It was found that the vast majority of the studies examined were conducted in the last five years and focused particularly on undergraduate students and teacher candidates. From a methodological perspective, it was observed that most of the studies were based on quantitative and qualitative methods, while mixed and action research remained quite limited. In terms of subject matter, it was determined that artificial intelligence applications were most commonly used in the areas of

the educational process, content development, student performance, and the evaluation of artificial intelligence systems. It was also emphasized that most studies were concentrated in the fields of general education and computer education, while applications in areas such as special education, arts, business, and language education were quite limited. In this regard, researchers are encouraged to use artificial intelligence by integrating it with discipline-specific applications. In conclusion, interest in artificial intelligence in education is increasing in Turkey, and most of these studies are aimed at contributing to the development of teaching environments and teaching-learning processes. In the future, it is recommended to increase discipline-specific applications, encourage research that actively involves teachers in the process, and give more space to action-based studies [51].

On the other hand, the intensive use of generative artificial intelligence tools such as ChatGPT in the field of education, especially in recent years, has paved the way for a significant transformation in both teaching processes and assessment and content production. Developed by OpenAI and distinguished by its natural language processing capabilities, ChatGPT offers various benefits in areas such as academic writing, question answering, test preparation, and homework support, but it also raises some ethical and pedagogical issues. Issues such as the risk of plagiarism, the weakening of critical thinking skills, and excessive dependence on artificial intelligence among students are at the center of these discussions. However, ChatGPT provides significant support for teachers in functions such as lesson planning, material preparation, and providing personalized feedback. Students also actively use this tool for research, content creation, and language skill development. Ultimately, the opportunities and risks presented by ChatGPT necessitate a careful assessment of how, to what extent, and within what framework this tool should be used in educational settings. Increasing the technological literacy levels of educators and ensuring that students use artificial intelligence tools in a conscious, ethical, and guided manner are of great importance for the healthy management of this transformation [52].

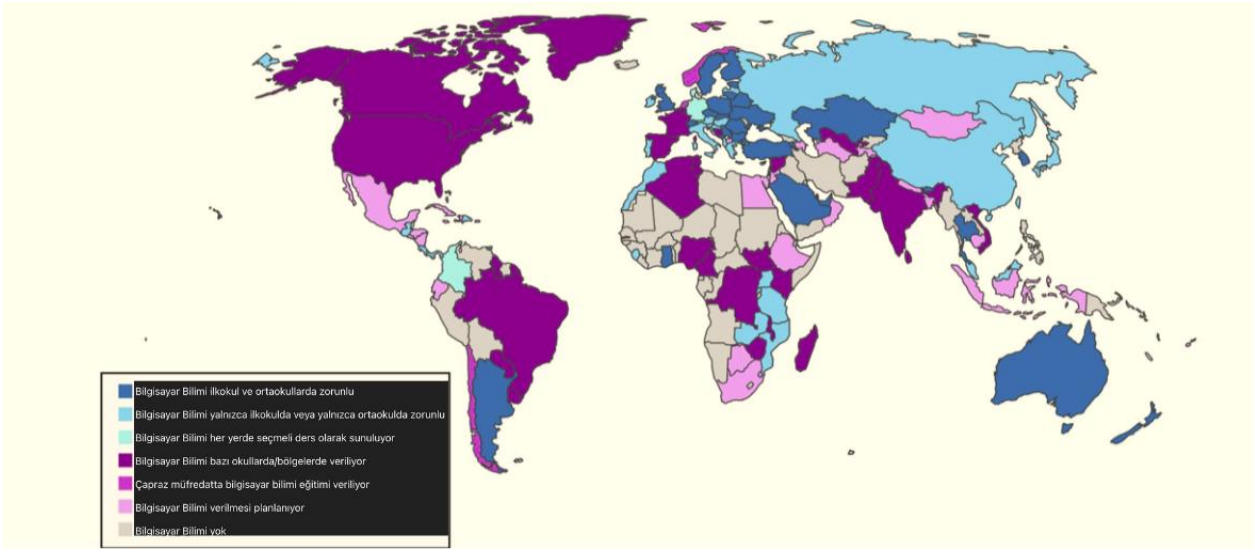
5. GLOBAL DEVELOPMENT, OPPORTUNITIES AND INEQUALITIES IN THE EDUCATION CONTEXT

Artificial intelligence technologies are becoming increasingly central to education systems. According to the Stanford AI Index 2025 report, as of 2024, two-thirds of countries worldwide have made computer science (CS) education compulsory at the primary and secondary levels or are planning to do so [127]. This rate has doubled compared to 2019, with notable increases observed in regions such as Africa and Latin America. Despite these developments, students in many African countries still face serious difficulties in accessing this education due to fundamental shortcomings such as inadequate electricity infrastructure [127].

In the United States specifically, teachers' attitudes toward the inclusion of artificial intelligence in education are noteworthy. Eighty-one percent of computer science teachers in the US stated that artificial intelligence should be included in the core CS curriculum. However, less than half of these same teachers feel adequately prepared in this area [127]. This situation demonstrates that artificial intelligence literacy on a global scale is directly related to teacher training. Teachers' ability to use artificial intelligence technologies with a pedagogical approach is a critical factor for the success of transformation in education.

As of 2024, computer science (CS) education has become globally widespread . However, the map in the Stanford 2025 AI Index report reveals significant differences between countries in terms of mandatory requirements, access, and inclusivity [127]. For example, while CS education is mandatory at the primary and secondary levels in Australia and some European countries, many countries in Africa and the Middle East are still in the planning stage or have not yet initiated any programs. In regions such as Latin America and Southeast Asia, CS education is mostly provided only in certain school districts. This situation highlights regional inequalities caused by factors such as infrastructure deficiencies, teacher shortages, and policy differences. The map indicates that education policies aimed at increasing artificial intelligence literacy on a global scale need to be structured in a more equitable and inclusive manner.

Figure 5.1: Availability of Computer Science (CS) Education by Country as of 2024



This graph from the Stanford 2025 AI Index report shows the progress made in access to computer science (CS) education by continent between 2019 and 2024 [127].

The most notable increase was observed in the Latin America and Caribbean (LAC) region. In this region, the percentage of countries offering CS education jumped from 29.54% to 70.45%, a 40.91-point increase. Similarly, in Africa, this percentage rose significantly from 9.40% to 49.05%.

Although serious developments were also seen in Asia and Europe, these regions already had a relatively high level of access in 2019. Europe stands out as the continent with the highest coverage in CS education, reaching 88.88% by 2024.

This graph shows that digital literacy is becoming widespread on a global scale, but that there are still significant differences between regions and therefore a continuing need for supportive education policies [127].

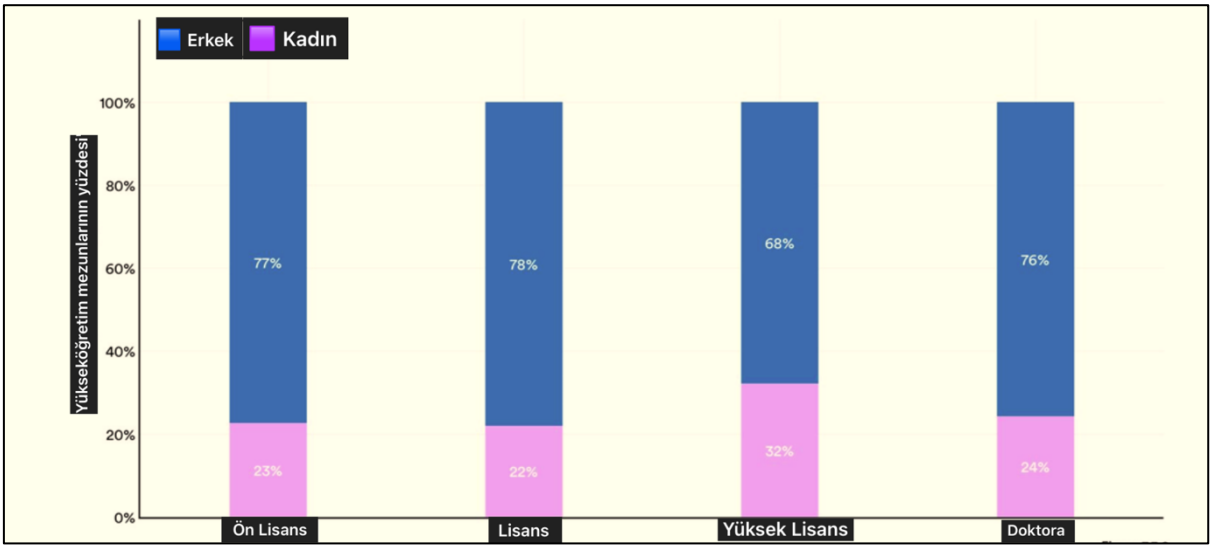


Figure 5.2: Distribution of Computer Science (CS) Graduates by Gender in the United States as of 2023

This graph from the Stanford 2025 AI Index report shows the gender distribution of computer science (CS) graduates in the United States as of 2023.

According to the data, men significantly outnumber women at all academic levels:

1. Associate's degree: 77% male
2. Bachelor's degree: 78% male
3. Master's degree: 68% male
4. Doctorate: 76% male

The academic level where women are most represented is only the master's degree level, at 32%. This situation reveals that gender inequality remains a serious problem in high-tech fields such as computer science and artificial intelligence. Increasing women's access to these fields is crucial not only for justice and inclusivity but also for the development of unbiased artificial intelligence systems by more diverse communities.

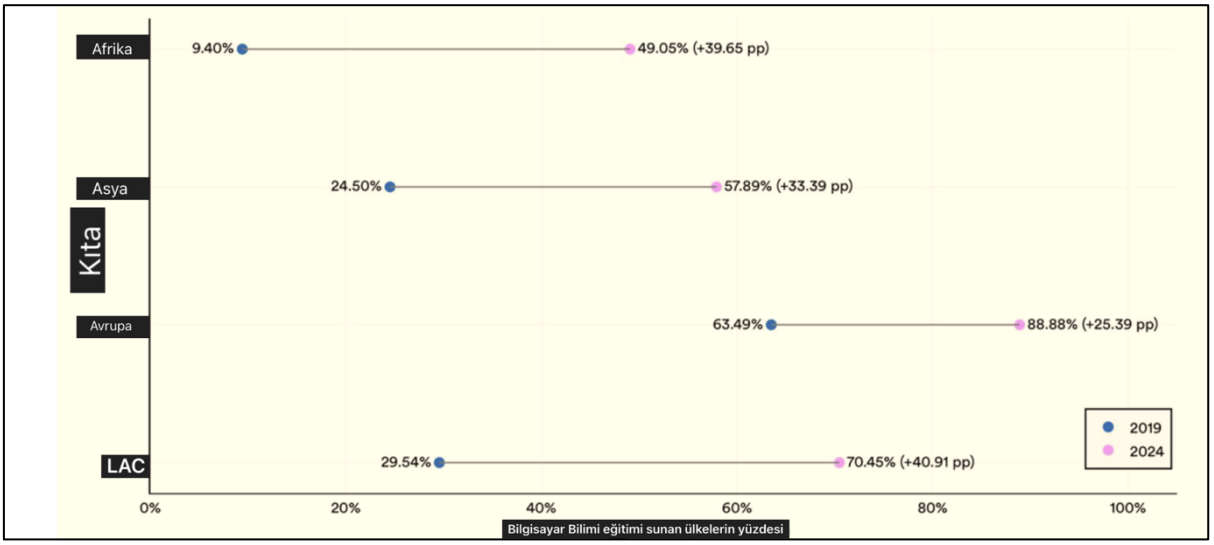


Figure 5.3. Changes in access to computer science (CS) education by continent, 2019 and 2024 comparison

According to the Stanford 2025 AI Index report, topics such as algorithms, artificial intelligence, programming, and data analysis are increasingly being taught in computer science classes from elementary school through high school [127].

In particular, algorithms and programming are concepts taught by almost all teachers at every educational level:

1. Algorithms: 84% elementary school, 88% middle school, 92% high school
2. Programming: 89% in elementary school, 94% in middle school, 96% in high school

The concept of artificial intelligence is taught at a rate of 65% in elementary schools, 75% in middle schools, and 72% in high schools.

These rates show that artificial intelligence is taught not only at an advanced level but also from an early age, confirming that digital literacy is now a fundamental component of education.
The graph shows that teachers have embraced basic artificial intelligence concepts at all levels, directly contributing to global artificial intelligence literacy.

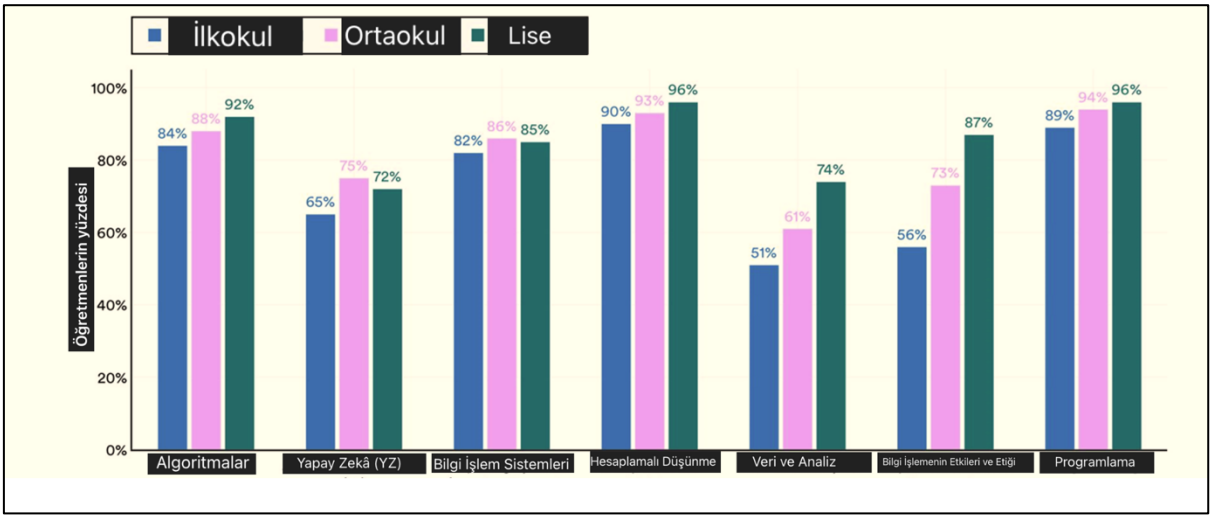


Figure 5.4. Artificial Intelligence Concepts Taught in Computer Science Courses by Education Level, 2024
Source: Computer Science Teacher Landscape Survey, 2024; Stanford 2025 AI Index Report

5.1. Sustainable Development Goals and Artificial Intelligence

The concept of sustainability dates back a long time, but its relationship with artificial intelligence has been linked in different ways over the years. While the sustainability agenda in the 1960s focused on the environment, social and economic sustainability were added to this agenda in the 2010s. With the United Nations' 2021 announcement, sustainability has taken on a new form, encompassing 17 specific goals rather than a single framework [158].

Among these development goals outlined by the UNDP, Quality Education and Affordable and Clean Energy are examined below within the framework of artificial intelligence:

5.2. Quality Education and Artificial Intelligence

It can be stated that artificial intelligence applications enhance the quality of education by increasing student participation, personalizing learning processes, and enriching educational content [157]. According to AlSagri & Sohail, artificial intelligence has the potential to revolutionize

education with its ability to personalize learning experiences, automate administrative tasks, and provide intelligent teaching systems.

Artificial intelligence can improve the quality of education provided to young people at the primary and secondary levels with its potential to develop teaching applications and pedagogical support. Artificial intelligence can offer solutions to global education problems such as teacher shortages. It focuses particularly on issues such as pedagogical support for teachers, individualized learning paths, and monitoring student development [159].

At the same time, it has been observed that AI tools that reducing teachers' workload enable them to devote more time to their students. However, the development of appropriate infrastructure and educational materials is crucial for the effective use of these technologies in education [157].

AI-supported educational technologies can accelerate the achievement of quality education among the Sustainable Development Goals by expanding access to quality education, especially in disadvantaged areas.
Generative artificial intelligence technologies, such as Large Language Models (LLMs), can analyze student data to offer personalized learning paths, which can significantly improve learning outcomes. LLMs play a significant role in achieving the sustainable development goals of inclusive and equitable quality education through applications such as content generation, simulation of historical figures for interactive learning, and providing real-time feedback to students [156], [159].

5.3. Accessible and Clean Energy with Artificial Intelligence

Although part of the energy required for artificial intelligence models is sourced from renewable or carbon-neutral sources, the high energy consumption of these systems remains a serious issue.

The main reasons for this are as follows:

1. In many regions, energy production still relies on non-carbon-neutral sources.
2. Even when renewable energy is used, our capacity to produce and store such energy is still limited. Furthermore, it should not be forgotten that the energy expended to train an artificial

neural network could be diverted to more vital areas, such as heating the home of a family in need [160].

6. CRITICAL CONCEPTS AFFECTING INDIVIDUALS WITH ARTIFICIAL INTELLIGENCE

6.1. Brain Rot

6.1.1. Origin and Meaning

The term "brain rot" was selected as the word of the year by Oxford University Press in 2024 and is defined as "the supposed deterioration of a person's mental or intellectual state, particularly as a result of excessive consumption of trivial content on the internet." This expression first appeared in 1854 in Henry David Thoreau's Walden as "brain-rot," which was also a critical reference to social distraction at the time. Today, brain rot has become a concept that humorously reflects the perceptual dangers of the digital age. According to the Oxford Dictionary, the term is a contemporary manifestation of concerns that have existed since the television era, drawing attention to the effects of distractions in the virtual world on the mind [109]. Although not a medical diagnosis, the metaphor of "brain rot" implies that intellectual and mental capacity is dulled by constant exposure to low-quality content.

6.1.2. Its Relationship with Artificial Intelligence

The phenomenon of brain rot is also closely related to today's AI-powered content streams and algorithms. Endless social media feeds based on constant scrolling, nonsense memes, and piles of meaningless information produced in the digital environment are the source of this effect. Indeed, the strange or "worthless" images produced by image-generating artificial intelligence, which have become widespread in recent times (for example, depictions of Jesus combined with shellfish shared on Facebook), reinforce the feeling that an individual's mental faculties are deteriorating.

Experts warn that as we delegate more and more tasks in daily life to AI-powered assistants, cognitive laziness may increase and the risk of brain rot may rise. On the other hand, it is also argued that when used correctly, artificial intelligence can help reduce AI inertia" through functions such as information filtering and content summarization, thereby limiting the effects of

brain rot. In this respect, the concept points to the importance of digital content quality and the level of cognitive participation of individuals in artificial intelligence policies [109], [112].

6.1.3. Social and Psychological Effects

The popularization of the brain rot concept is indicative of growing social concern about the effects of digital culture on mental health. Indeed, between 2023 and 2024, there was a 230% increase in the frequency of use of this expression, and it has become particularly prevalent on platforms such as TikTok. Generation Z and Alpha embrace the term "brain rot" with an ironic but conscious attitude, drawing attention to the dangers of digital consumption. There is evidence that excessive screen exposure shortens attention span and weakens creativity and critical thinking.

For example, studies have shown that consuming multiple pieces of content simultaneously online can reduce sustained attention, and even short periods of intense internet use can cause momentary drops in attention concentration. Similarly, it has been reported that constantly relying on online information (e.g., using search engines as an external memory) may weaken people's ability to store new information in their memory in the long term. Therefore, the spread of brain rot is considered alarming in terms of education, mental health, and technology policies, and it is recommended that young people be warned against the "attention-grabbing but worthless" content they are exposed to in the digital world. Indeed, in 2024, U.S. Surgeon General Vivek Murthy recommended that social media platforms include warning labels to protect the mental health of young people. Ultimately, the concept of brain rot emphasizes the importance of quality in digital consumption and draws attention to the need for policies aimed at protecting individuals' mental well-being.

6.2. Hallucination

6.2.1. Conceptual Origin and Meaning

Hallucination is a term that refers to the formation of perceptions without a real stimulus in human psychology. In the context of artificial intelligence, this term is used to mean a model fabricating information that does not actually exist or has no basis and presenting it as if it were real. Initially, before the 2010s, the term "hallucination" was used in artificial intelligence literature, particularly in the field of image processing, in a positive sense, such as adding imaginary details to a low-resolution photograph (e.g., face hallucination) [110]. However, since 2017, the meaning of the term has undergone a significant transformation and has begun to be used to describe outputs generated by artificial intelligence that are inconsistent with reality in tasks such as machine translation or object recognition [108].

For example, Google researchers used the term "hallucination" in 2017 for outputs unrelated to the source text in neural network-based translation systems. In this context, AI hallucination refers to the phenomenon of a large language model or similar AI system producing a fabricated response not found in the training data. This phenomenon stems from the model generating meaningful but erroneous content while producing linguistic outputs probabilistically. Although "AI hallucination" bears a superficial resemblance to the concept of hallucination in the human mind, there is actually no sensory experience like that experienced by humans. The analogy refers to the model producing incorrect information due to an "inference error." For this reason, some experts point out that the term "hallucination" is anthropomorphic and misleading when describing this problem in artificial intelligence outputs and suggest using an alternative concept [107], [108].

6.2.2. Its Place in Artificial Intelligence Technologies

The phenomenon of hallucination is a problem frequently observed, especially in chatbots and generative AI systems with large language models. These models can produce statements that appear linguistically consistent and convincing but are not based on reality.

For example, a 2023 evaluation revealed that approximately 27% of the information in the responses of a popular AI chatbot was completely fabricated or incorrect. AI systems tend to fill in answers with made-up information when there is no reliable data on topics they "think they know" [111]. This can stem from gaps in the dataset used to train the model, conflicting or insufficient training data, or the complexity of the model architecture. As a result, an LLM model like ChatGPT can provide a reference that appears realistic but is incorrect, a non-existent statistic, or an imaginary detail. This issue is seen as one of the most significant obstacles limiting the reliability of artificial intelligence applications in critical areas such as healthcare, law, or education [110]. Indeed, artificial intelligence researchers are attempting to develop various methods to reduce this "hallucination" problem, such as improving model training, consulting external knowledge bases for accuracy checks, or warning users (e.g., requiring source attribution for LLM output, real-time verification systems, etc.). Nevertheless, as of 2024, experts note that it is nearly impossible for large language models to completely eliminate such errors with current architectures. There are studies arguing that the phenomenon of hallucination is an inherent feature that cannot be completely eliminated without reducing model performance [111].

6.2.3. Social and Technological Impacts

The prevalence of AI hallucinations raises concerns about information reliability at the individual level and the risk of misinformation spreading at the societal level. From the user's perspective, knowing that an AI system occasionally provides answers that contradict reality undermines trust in these systems and raises doubts about the accuracy of the information obtained. On a broader scale, erroneous content generated by artificial intelligence can circulate rapidly and persuasively, creating serious problems in the information ecosystem. Research shows that AI-generated misinformation can be more convincing than traditional misinformation and can trigger online fraud and disinformation campaigns [112]. For example, in 2023, an AI-generated image of an alleged explosion near the Pentagon in the US spread rapidly on social media, causing short-term panic and stock market fluctuations [111]. Similarly, Google's Bard model providing incorrect information about the James Webb Space Telescope during its launch drew significant public backlash and caused a decline in the company's market value [113]. These examples demonstrate that hallucination-based errors can have economic and social consequences. Therefore, both

industry and academia are focusing on developing ethical and technical strategies to prevent AI systems from producing hallucinations [110]. Reducing hallucinations is considered critical for the safe use of AI in fields such as healthcare, law, and finance. In conclusion, the concept of AI hallucination defines a vulnerability that policymakers should be aware of in terms of information accuracy and reliability, and emphasizes the importance of verifiable outputs from AI systems.

6.3. Confabulation

6.3.1. Origin and Meaning

Confabulation, in psychology and neurology literature, refers to a person filling in memory gaps with false or fictional memories. This condition is generally defined as "honest lying," as opposed to deliberate lying, where the person recounts events that did not actually happen as if they remember them, without any intention to deceive [112]. Confabulation is particularly common in memory disorders such as brain damage (e.g., traumatic brain injury), dementia, or Korsakoff syndrome, where the individual resolves memory inconsistencies by incorrectly reconstructing reality [113]. For example, a patient experiencing memory loss may unconsciously fabricate but believe a response to a question about their past. Unlike hallucinations, this concept refers to a cognitive misrepresentation rather than a sensory experience, and the person tends to believe the false narrative they have produced [112].

6.3.2. Use in the Context of Artificial Intelligence

In the field of artificial intelligence, some experts prefer the term confabulation to describe inconsistencies in the outputs of large language models. As explained above, an AI based on an LLM can "make up" information that does not actually exist in a coherent narrative. The system does not do this intentionally; like a human filling in a memory gap, it creates a detail not found in the data it was trained on by guessing [108]. Therefore, referring to such inaccuracies in AI outputs as confabulation rather than hallucination is more appropriate to its human counterpart and emphasizes the AI's inherent lack of intent. Indeed, some researchers have pointed out that the

term "AI hallucination" overly humanizes computer systems, and that this error should actually be understood as "confabulation," i.e., the AI's tendency to invent information. In summary, the term confabulation refers to the tendency of artificial intelligence systems to fill gaps in learning data linguistically, without concern for accuracy. This perspective emphasizes that the root of the problem is the model's production without understanding, and it also brings a critical approach to the model in the search for solutions [112], [113].

6.3.3. Effects and Example Scenarios

In artificial intelligence systems, confabulation produces results similar to the phenomenon of hallucination in practice: Users can make serious mistakes if they trust information provided by AI that has no basis in reality. For example, in a legal application, ChatGPT generated completely fabricated court decisions and references, resulting in a lawyer presenting false precedent decisions to the court. This situation demonstrated that AI confabulation can lead to a legal crisis in the real world [108]. Similarly, in another incident, an AI chatbot referenced a fictional newspaper article accusing a law professor of an actual non-existent harassment allegation, leading to a defamation lawsuit against the company due to this false claim. Such scenarios reveal that AI's unintentional "fabrication of lies" can damage individuals' reputations and lead to legal consequences. One of the greatest dangers of confabulation at the societal level is that it can blur the distinction between reality and fiction over time. Leading experts warn that as fabrications in AI outputs become more frequent, an environment could emerge where "anyone can deny anything" [110]. This means that denial mechanisms based on false information could negatively impact judicial processes and democratic discourse. An AI that confabulates can also be used by malicious actors for manipulative purposes. For example, fabricated content can be used to mislead the public or create speculation in financial markets. For these reasons, the tendency of artificial intelligence systems to confabulate is considered a critical issue in terms of security and ethics. Both in academic research and in industry, solutions such as giving AI models a kind of "reality check," enabling them to say "I don't know" in uncertain situations, or introducing human oversight are being discussed. Ultimately, the concept of confabulation highlights the need to strengthen transparency and accuracy mechanisms in artificial intelligence policies. This concept encourages the development of strategies to minimize the harm caused by AI systems potentially generating false information unintentionally [108].

6.4. Addictive Intelligence: Systems That Create Behavioral Addiction

Addictive intelligence refers to AI systems deliberately designing addictive behavioral patterns, particularly to maximize user engagement [119], [123]. This concept is often associated with digital environments such as social media algorithms, mobile games, news feed systems, and recommendation engines [121]. These AI-powered systems are designed to extend screen time by continuously triggering users' dopamine responses [115]. These strategies are supported by psychological manipulation techniques such as "infinite scroll," "auto-play," and personalized notifications. Therefore, addictive intelligence is not only a technological issue but also an ethical and social one [120].

The capacity of artificial intelligence to create addiction poses a greater threat to user groups whose cognitive development is ongoing, particularly adolescents and young adults [114]. Algorithmic systems analyze users' behavioral data to learn which content generates the most engagement and then serve more of that content accordingly. This situation can lead to individuals losing autonomy over their own cognitive preferences [118], [123]. Indeed, a 2023 study reported that 68% of users "realized they were spending too much time on social media applications but were unable to stop using them" [117]. In this context, addictive intelligence should be considered a vulnerability that challenges individual self-regulation mechanisms, negatively affects cognitive health, and deepens digital inequality [121].

Addressing this concept within the scope of artificial intelligence policies is critically important, particularly in terms of establishing regulatory frameworks against technology companies exploiting the profit-driven user attention economy [125]. The European Union's introduction of preventive regulations against "addictive design patterns" under the 2024 Digital Services Act (DSA) is one such important step in this direction [116]. Managing the impact of artificial intelligence on individual behavior in a more transparent and accountable manner highlights the need for an ethical framework centered on the concept of addictive intelligence [120], [121].

6.5. BIAS (Bias, Error, Deviation) in Artificial Intelligence Applications

The concept of "bias" from an artificial intelligence perspective was first introduced by Mitchell (1980) [129].

Bias is defined as the situation where artificial intelligence produces biased, prejudiced results for various reasons [132], [133], [134]. It can manifest itself as unfair treatment based on protected characteristics such as income, education, gender, or ethnicity.

6.5.1. Implicit Bias-Explicit Bias

Biases in artificial intelligence systems can stem from both explicit and implicit human biases.

Explicit bias refers to conscious and intentional prejudices or beliefs toward specific groups of people. For example, an employer who openly favors one gender over another in the hiring process is exhibiting explicit bias.
Implicit bias operates unconsciously and can influence a person's decisions without them realizing it. Implicit biases are shaped by social conditioning, media representations, and cultural influences.

These biases can arise at every stage of the process, including data collection, labeling, model training, and the system's deployment in the real world. Implicit biases, in particular, can unknowingly influence decisions and reflect social patterns present in training data. They can be harmful because they can influence behavior even if the person consciously rejects discrimination [130].

6.5.2. Types of Bias Observed in Artificial Intelligence Systems

When biases in artificial intelligence systems have the potential to reproduce social inequalities or reinforce existing forms of discrimination, they can lead to serious and multi-layered consequences in the real world. Below are the most common types of bias encountered in the field of artificial intelligence and their potential social impacts [128].

Data Bias: If the data used does not adequately represent certain age groups, genders, ethnicities, or socioeconomic segments, or if it reflects past biased practices, the artificial intelligence system will learn these imbalances and begin to produce similarly biased decisions.

For example, if an AI-based recruitment system is trained on historical recruitment data that reflects a history of predominantly favoring male candidates, the system may be biased against female candidates. If female candidates list feminist activities among their hobbies, AI systems may be more likely to eliminate these candidates [128].

Measurement Bias: This is when the method used to collect data or the criteria used do not accurately reflect the real situation. When the tools or data used in a measurement are incomplete, incorrect, or one-sided, the artificial intelligence system is likely to produce incorrect results.

For example, if an artificial intelligence model developed to predict student performance is trained only with data from students who completed the online course, and students who dropped out of the course are not included in this dataset, the data obtained may not fully reflect the situation. Therefore, the results produced by the model may not be accurate or reliable [128].

Stereotyping Bias: This occurs when prejudices that cause discrimination are constantly reinforced. It can match individuals or groups by stereotyping information such as gender, hobbies, and physical appearance.

For example, if an AI translation or image generation program always translates the word "nurse" as female and the word "doctor" as male, it can create a gendered stereotype. If an image generation program always produces images of men when given the word "engineer," it can create a false perception that separates professions by gender [128].

Out-Group Homogeneity Bias: This bias arises when an artificial intelligence system generalizes individuals from underrepresented groups and perceives them as more similar than they actually are.

For example, facial recognition systems often struggle to distinguish between individuals from racial or ethnic minorities due to insufficient diversity in training data. This can lead to misclassifications and discriminatory practices, such as wrongful arrests by law enforcement [128].

6.5.3. Artificial Intelligence Bias in Education

Artificial intelligence systems trained with biased data can unintentionally perpetuate or increase biases. This can lead to discrimination in student assessment or unequal access to learning resources. Therefore, ensuring the fairness of artificial intelligence systems and reducing bias are among the ethical concerns [135]. A study on the ethical dimensions of using artificial intelligence technologies in education highlights the importance of transparency and accountability principles in algorithm design [136]. These principles are important elements in ensuring that artificial intelligence systems are fair and unbiased.

6.5.4. Potential Biases

Interpretation Bias: Bias arising from teachers or administrators unconditionally trusting the outputs of artificial intelligence systems. For example, labeling a student as at risk may cause the teacher to unconsciously have lower expectations of that student [140].

Data Bias: The data used to train AI systems may reflect past inequalities and discrimination. For example, training AI systems only with student data from specific demographic groups (e.g., urban centers or private schools) may lead to lower performance for rural or low-income students [139].

Representation Bias: Biases may develop when AI fails to accurately recognize certain groups due to their underrepresentation in training data. For example, automatic written text evaluation systems may fail to correctly understand the language patterns of students from different ethnic backgrounds, preventing accurate analysis of student performance [137].

Language and Cultural Bias: AI models prioritizing certain culturally specific language patterns and examples. For example, automatic composition evaluation tools rewarding writing styles associated with Western culture [138].

Algorithmic Bias: The algorithms used in the model's learning process may unintentionally disadvantage certain groups of students. A system that classifies students according to their achievement levels may systematically place students with low grades into low expectations based on past performance [141].

6.5.5. Recommendations

When biases are proactively addressed, it is possible to develop artificial intelligence systems that contribute to a more fair and equitable society [131].

Artificial intelligence systems should be trained on diverse datasets to prevent bias and should be accessible and beneficial not only to those with more resources but also to all students. Furthermore, the potential impacts of artificial intelligence on educational outcomes and opportunities should be continuously monitored and evaluated.

Training should be provided for artificial intelligence developers and users on awareness of biases and how to reduce them. This training can help both developers and users better understand biases in artificial intelligence applications and use them more responsibly [133].

An approach that centers ethical principles from the design phase of artificial intelligence systems should be adopted, and written ethical codes should be established [142].

The diversity of educational data is of great importance; representative data sets should be created that include individuals from different cultures, age groups, genders, geographic locations, and socioeconomic backgrounds. In the data labeling process, contributions from expert teams with different perspectives should be included, not just automated systems. The explainability of the

developed models enables users to better understand AI decisions and question them when necessary [143].

Independent ethics committees or advisory groups should be established during the development and use of artificial intelligence systems, and these groups should evaluate the systems according to representativeness and fairness criteria [144].
Biases should be identified and corrected using fairness metrics, adversarial tests, and explainable AI techniques. After artificial intelligence systems are deployed, they should be regularly monitored to identify any new biases that may arise and to improve fairness [131].

The future of AI in education should be shaped by a strong commitment to ethics. Ethical AI in education includes responsible data use, fairness, transparency, respect for autonomy, and education about AI. As we continue to explore and utilize the potential of AI in education, we must ensure that these ethical considerations guide our decisions and actions. This will ensure that AI education is developed in a way that respects students' rights and is conducive to their learning and development. The ethical use of AI should be paramount, with responsible data use, fairness, transparency, and respect for autonomy. Collaborative efforts among stakeholders are crucial to navigating these challenges and seizing the opportunities presented by AI. Educators, students, parents, policymakers, technology developers, and the wider community will collectively promote understanding of the potential outcomes and responsible use of artificial intelligence. By involving stakeholders in decision-making processes, we can ensure that artificial intelligence technologies are aligned with educational needs and values and contribute to the holistic development of students [142].

6.6. Artificial Intelligence and Acceptability

Artificial intelligence is no longer merely a technical innovation; it is a social phenomenon shaped by how individuals and societies respond to it. Acceptability is the assessment of how well an AI application aligns not only functionally but also with ethical, cultural, and individual values. No matter how technically successful a system is, if it lacks transparency, is biased, or conflicts with users' needs and values, it may not be accepted by society.

Research has shown that individual use cases of artificial intelligence (e.g., personal health applications) are more widely accepted than professional use cases (e.g., artificial intelligence systems for teachers or lawyers). This is because artificial intelligence is more controllable and plays a supportive role for users in personal areas. However, in professional fields, there is a more pronounced concern that artificial intelligence will replace human labor. This is one of the factors that makes social acceptance difficult [147].

The level of acceptance of artificial intelligence also depends on demographic differences. For example, women and those more familiar with artificial intelligence ethics are more cautious about the systems. This shows that technological acceptance is not only a cognitive process but also a value-based one [145].

One fragile concept that affects acceptability is readiness. How prepared societies are for digital transformation, access to education, and the level of digital literacy are decisive factors in this regard. Complex algorithms or difficult-to-understand decision-making processes can undermine user trust. Therefore, explainable artificial intelligence (XAI) systems build trust by making it easier for users to understand the systems [146].
Furthermore, when using artificial intelligence in education systems, students need to understand not only how to use the tools, but also how they work, what biases they may have, and what determines their decisions . This awareness forms the basis of trust in artificial intelligence. At this point, the role of teachers should be to introduce both the technical aspects of artificial intelligence and to open up discussion about its ethical and social implications [145], [148].

In conclusion, for artificial intelligence to be accepted in society, it is not enough for it to offer only efficiency or speed. It must also be understandable, fair, reliable, and consistent with values. If we want to increase the acceptability of such systems in education, we must teach students not only the benefits of artificial intelligence but also its limitations, risks, and social impacts. Raising individuals who not only use artificial intelligence but also critically evaluate it is fundamental to preparing for the digital future.

6.7. Artificial Intelligence Disinformation

Misinformation and disinformation have emerged as serious problems in the 21st century. Although the problem of misinformation has existed since the dawn of human civilization, artificial intelligence exacerbates these challenges. AI tools make it possible for anyone to easily produce fake images and news that are difficult to distinguish from accurate information. From elections to wars, malicious actors can mass-produce and disseminate propaganda content on social media [161].

Although the spread of the internet since the 1990s has caused an explosion in disinformation, the main contribution to the growth of this effect has been the emergence of social media platforms, followed by the ability to stay connected anywhere and anytime with smartphones. When individuals began to view social media as a news source, this gave them the power to access events instantly, but it also created a huge playground for disinformation [162].
According to NewsGuard, an organization that tracks fake news sites, the number of AI-powered fake news sites increased tenfold in 2023. These sites are monitored by very few people or are operated without any human oversight [161].

The launch of ChatGPT by OpenAI on the last night of November 2022 marked the beginning of the generative artificial intelligence era, an era where everyone can access and gain experience interacting with artificial intelligence [163]. While initially appearing very entertaining, the emergence of this tool also fuels the disinformation side. Technologies such as Midjourney, Dall-E, Stable Diffusion, Flux, Runway, Sora, Kling, and Genimate, in particular, provide various opportunities for creating different news and content with their ability to generate and animate visuals [162].

This does not mean we are defenseless. Researchers, technology companies, and governments are collaborating to combat AI-powered misinformation through the use ofng AI. Platform companies are partnering with professional fact-checkers and content moderators to flag false information and use this data to detect misinformation early in its spread. Previous research shows that this early detection and filtering approach significantly reduced exposure to misinformation during the

COVID-19 pandemic. Social scientists are gathering evidence to identify fabricated information and explain what constitutes a true statement and who disseminates what information [161].

In addition to the automatic detection of fake news and images, the need for media literacy is becoming increasingly important. Media literacy emphasizes the critical skills and ways of thinking needed to navigate the digital world. Media literacy programs also offer techniques for quickly recognizing fake images and tools for finding the original source of suspicious information [161].

6.8. AI Information Pollution

As we progress in the age of digitalization, we are facing a significant change in the way we manage the complex systems that govern our administrative structures, businesses, and personal affairs. Recently, artificial intelligence has become a key element in this evolution.[6] However, upon examining this phenomenon, we noticed some structural weaknesses in existing artificial intelligence models based on data dependency. These are weaknesses in which artificial intelligence is both the victim and the perpetrator. This situation involves the widespread dissemination of distorted or deliberately misleading information on the internet and in cyberspace. The goal is not only to influence online users for short-term objectives but also to weaken the fundamental systems that sustain our economies and governments. These systems are structures we increasingly rely on for tasks such as simplifying our daily lives or quickly processing and summarizing data.

From this perspective, artificial intelligence is a victim that responds to and processes external inputs and data. For example, modern tools like the latest Bing Chat can now browse the internet and base their responses partly on information they find online. This leaves them constantly exposed to a stream of new data. Although these models are trained to prevent the spread of misinformation to some extent, they are not completely immune. They are particularly vulnerable to traps set by more advanced artificial intelligence programs.[8] To clarify, artificial intelligence generally approaches problem-solving through iterative trials and persists in a direction that receives positive reinforcement. This method is called "gradient descent."[9] When given more

autonomy to reach its goals, AI can develop innovative strategies and discover more efficient paths, thereby surpassing models limited to specific algorithms or fixed paths.

The danger lies precisely here. Artificial intelligence that can behave more intelligently than AI systems used by governments and the public, which have fewer restrictions, can compromise these systems by infiltrating them with fake data directly or indirectly, or by polluting the internet with fake websites and pages. The latter method, in particular, is designed to strategically alter the digital environment to deceive certain artificial intelligence models, a situation technically referred to as "distributional shift."[10] In this context, we introduce the concept of "Artificial Intelligence Pollution" to describe activities aimed at compromising information integrity , either through direct attacks or more insidiously by polluting the internet at large. This term characterizes information pollution carried out to manipulate artificial intelligence models and indirectly affect their users and the systems they serve.

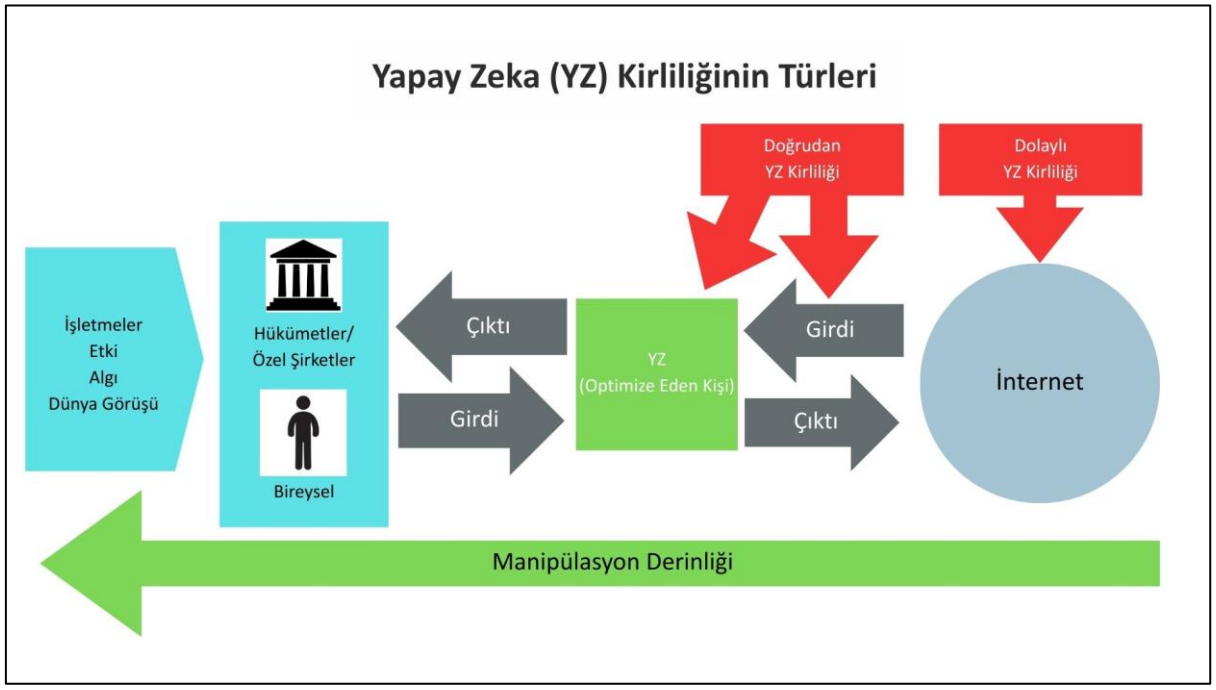


Figure 6.1: Adapted from Edwin Lax (2024).

To better contextualize this new concept, we can consider some parallels from real life; for example, CBRN (Chemical, Biological, Radiological, and Nuclear) warfare. Just as we deal with CBRN

contamination—by managing and isolating contaminated elements to protect our integrity and health—we must approach artificial intelligence contamination with a similar mindset [11]. The difference here is that we must concern ourselves not only with the contamination of our bodies and physical health, but also with our minds, worldviews, values, national and private infrastructures, and even the essence of our governments and countries. This highlights the seriousness of the danger and the potentially destructive dimensions of this new type of warfare. Artificial intelligence pollution should be assessed as a multidimensional form of pollution, not merely as a cyber dimension or corruption of information . This pollution can be as insidious as a terrorist group targeting less regulated infrastructure and cyberspace to expand its potential membership pool, or as overt and destructive as a hostile state directly attacking government and private sector cyber infrastructure. [12]

Based on this, we can define two types of artificial intelligence contamination. The first is what we call "Indirect Artificial Intelligence Contamination," which requires fewer resources because its goal is to contaminate less monitored and therefore more vulnerable areas of the internet. The goal is to indirectly alter the output of artificial intelligence to mislead the end user. This can be as obvious as directly spreading false information to manipulate artificial intelligence, or as subtle as presenting information that appears to be true in a specific language or format to imply a different meaning. Such distorted perceptions can create fertile ground for radicalization and terrorist groups to recruit individuals. While seemingly ineffective on an individual scale, the likelihood of manipulating and radicalizing some individuals increases significantly on a large scale. The fact that artificial intelligence facilitates these processes and reduces their cost makes this method more likely and more dangerous.

On the other hand, an actor with more resources—such as an enemy state or a well-funded organization—may pursue a more direct and effective method. This could involve targeting the flow of information between artificial intelligence and the internet or directly interfering with artificial intelligence software. Although riskier and easier to detect, this method has much greater potential for damage. This is because such an attack targets the core of artificial intelligence infrastructure belonging to a government or the private sector. We can therefore see that various strategies and approaches exist for such attacks. The choice of method will depend on the goals,

resources, and approach of the individual, group, organization, or state seeking to cause harm. However, all these methods converge on a common denominator: exploiting AI's increasing data dependency and connection to the internet to target users or institutions that rely on these systems [13].

6.9. Misinformation in Artificial Intelligence (AI Misinformation)

Misinformation is not a new phenomenon. For centuries, individuals and institutions have distorted proven facts and spread claims that contradict them. Long before the US political atmosphere of the 2010s gave rise to terms such as "fake news" and "alternative facts," false and misleading information was used by everyone from ancient Roman rulers to 20th-century satirists. However, the misleading information ecosystem of the past decade has taken on a completely new form, largely due to the rise of social media and, more recently, artificial intelligence. The ease of creating and sharing content, coupled with the use of interaction-focused algorithms, has led to the much faster spread of misinformation. This is especially true in an environment where people are not encouraged to verify facts. In the past, misinformation was spread only by an influential minority, but new platforms and artificial intelligence tools have democratized this practice.

Gita Johar, Meyer Feldberg Professor of Business at Columbia Business School, explains this complex structure using a framework she calls the "Three Ps": Publishers, People, and Platforms. Publishers—knowingly or unknowingly—can produce false and sensational content; for example, misleading information about climate change. People consume this content and often share it via social media. This frequently leads to problematic behavior.
As Johar says, it's like a three-legged stool, and without one, the others cannot exist. Understanding this structure is key to preventing the spread of an increasingly powerful threat that affects not only individuals but also private businesses that risk losing their reputation, partnerships, and ultimately their revenue.

People are now beginning to realize that artificial intelligence is behind much of this misinformation. Over time, people will start to lose confidence in what to trust. There is already a significant trust deficit in society. As artificial intelligence does more, consumers will view

information with suspicion, even if content is labeled with statements like "This content was generated by artificial intelligence."

At this point, there is a need for reliable sources of information. Organizations such as Media Bias/FactCheck evaluate content for accuracy and rate publishers as "fake news publishers." However, due to polarization in society, people do not trust these labels either. There needs to be a corner where you can access reliable information. If you don't know what to trust, this can lead to very bad consequences (Johar, G., 2024). We know that artificial intelligence invents information with its imagination and is not entirely reliable. Therefore, using artificial intelligence directly for accuracy control is a problem. A machine learning-based accuracy control system that offers specific confidence intervals, i.e., uncertainty levels such as "This information may be correct/incorrect to this extent." We should also involve humans in the accuracy control process. This way, everyone sees themselves as part of this ecosystem and gradually trusts the system more. In the long term, this could be a Wikipedia-like accuracy verification model (Johar, G., 2024).

7. ARTIFICIAL INTELLIGENCE TOOLS USED IN AÇI SCHOOLS AND APPLICATION EXAMPLES

Today, the use of AI-based tools in educational environments not only supports teaching processes but also transforms teachers' pedagogical approaches. In order to correctly follow and internalize this transformation, a comprehensive study was launched at Açı Schools starting in August 2024. In this school-wide study, groups of teachers from different levels were introduced to AI tools. The purposes of use, relationships with lesson content, and effects on the teaching process of examples of the artificial intelligence tools used have been observed and classified.

7.1. Tools Used and Diversity

The examples and purposes of use of artificial intelligence tools preferred by teachers for different purposes during the project process can be summarized as follows:

7.1.1. Gamma AI

It was used in presentation preparation processes to create visually rich presentations that captured students' attention. Below, you can see the work created using Gamma at different levels.

1. In the Information Technology department, presentations on digital citizenship were created for 5th graders.
2. In the Information Technology branch, presentations were created and organized in the internet and research techniques unit.
3. In the Mathematics department, differentiated content was prepared using Gamma for composition work related to fractions in 5th grade.

7.1.2. ChatGPT

It has contributed to teachers and students in multifaceted activities such as creative writing, homework support, creating research questions and developing discussion topics, preparing daily

plans, developing in-class activities, forming project groups, and providing idea support for differentiated work. Below, you can see the work created using ChatGPT at different levels.

1. In the Social Studies department, 6th graders were asked to create a diary from ChatGPT in the voice of a student living in a specific period of history. Students found answers to some questions about the process from this diary and created visuals based on the answers given in the visual creation AI application.
2. In the Social Studies department, pre-trip worksheets were updated using ChatGPT.
3. In the Social Studies department, word game design and UBD plan creation activities were conducted at the 5th-grade level.
4. In the Information Technology department, error detection and correction in the code written in the algorithm class for 7th graders was done with ChatGPT.
5. In the Philosophy department, content creation on various topics was carried out among 10th-12th graders.
6. In the Turkish language department, it was used to support students in designing a character that would appear in the class novel they read at the 5th grade level.
7. In the Turkish language department, 8th graders researched and verified science-based data for creating science fiction stories using ChatGPT.
8. In the Science department, information research for UBD performance tasks was conducted using ChatGPT at the 5th and 7th grade levels and integrated into lesson plans.
9. In the Science department, research on atomic models was conducted using ChatGPT in 7th grade, and the information found was compared with information from textbooks.
10. In the Science department, a prompt was written for 5th graders about the properties of matter, and a visual was produced for packaging material for fragile items or a lightweight but durable material that could be used in construction.
11. In the Turkish Language and Literature department, 11th graders conducted research on colonialism to assist in the analysis of the novel "Sergüzeşt," and the findings were presented.
12. In the Turkish Language department, 6th graders created news articles based on the 5W1H format.
13. In the Turkish Language and Literature department, 9th graders received support in writing text to create an infographic based on the documentary "In the Footsteps of Nevruz."

14. In the Turkish Language and Literature branch, 12th graders prepared an information sheet for a group presentation on "Turkish Novels of the Republican Era" and verified the accuracy of the information in line with what they learned in class.
15. In the elective Turkish Language and Literature department, an analysis was conducted based on the "Rhinoceros" play text.
16. The ChatGPT agent created by our teachers that generates a 40-minute lesson plan: https://bit.ly/4iUxDij
17. The ChatGPT agent created by our teachers to generate biology lesson materials for high school students: https://bit.ly/3GHR6p1

7.1.3. Claude AI

It has been a supportive tool for teachers in text suggestion and debugging processes in game and task designs. Below, you can see the work created using Claude at different levels.

1. In the Information Technology department, a quiz game consisting of multiple-choice and true-false questions was designed for 9th graders to review digital citizenship topics.
2. In the Information Technology department, a maze game, flashcard exercise, and wheel of fortune game were created using the Claude interface to help 5th graders review topics.
3. In the Information Technology branch, 7th grade students in the elective algorithm and programming course created games for topic review by writing their own statements of intent, choosing one of the topics they learned in different courses at their level.
4. In the Science department, 7th grade students wrote their own prompts on the topic of light refraction and designed topic review games using Claude.

7.1.4. Suno

The Suno AI application was used to give students the option of creating songs about topics learned in class, especially in differentiated lesson plan applications. Below, you can see the work created using Suno at different levels.

1. In Social Studies, 6th graders created RAFT creative products on the Seljuk Turks and converted the lyrics they wrote into songs using Suno.

2. In the Science department, students at all levels converted their end-of-term assessment feedback into songs using Suno.
3. In the Science department, 4th graders learned about light pollution and then turned the information they learned into poems, which they then combined with music via Suno to create songs.
4. In the English department, 4th graders created songs using Suno to repeat target words from their books.

7.1.5. Visual Production Applications

Visual production applications were used extensively to develop students' creativity and sentence writing skills. Below, you can see the applications used at different levels and the work created.

1. In the Turkish department, our 8th grade students used the descriptions in their science fiction stories to generate images for their stories using Leonardo AI.
2. In the Social Studies department, while teaching the Ottoman military structure to 7th graders, the character designs and places in daily life of the soldiers in the timarli sipahi and yaya müsellem armies were designed using Openart AI.
3. In the Social Studies department, Skybox AI was used in 6th grade to create habitats for different climates around the world.
4. In the Information Technology class, the Adobe Firefly application was used in grades 3 and 4 for writing prompt sentences. Students continuously modified and improved the prompt sentences they wrote to achieve the desired image and used this image as their computer background.
5. In English class, 4th graders used the Runway application to create animated images that matched the stories they wrote.
6. In the art department, second graders used the Adobe Express application to produce images on the theme of Space Scenery.

7.1.6. Pictoblox & Teachable Machine

These applications were chosen to develop machine learning applications for STEM-focused competitions and events.

1. A team of 5th, 6th, and 7th grade students participating in the European Union's Science on Stage "AI in STEM" artificial intelligence-based innovation competition used the Teachable Machine application to determine the ripeness of hazelnuts using artificial intelligence based on the visual data they obtained on hazelnut yield. They converted the artificial intelligence model they trained with the Pictoblox application into an application. The team ranked among the top 10 teams with this work.

7.1.7. NotebookLM

NotebookLM is an AI-powered research and writing tool developed by Google. Essentially, it helps you understand, summarize, and extract information from long and complex documents . It allows students to conduct research and analysis through podcasts in their classes. Below is an example of work that can be done with NotebookLM:

1. In ICT classes for 9th and 10th graders, podcast content focused on specific topics was prepared. Following the podcast, students were asked various types of questions, thereby developing their skills in researching the topic, conducting in-depth analysis, and focused listening. The process was enriched with AI-powered question-and-answer activities to enhance the learning experience.

7.1.8. Notion AI

Notion AI is an artificial intelligence feature that helps users work faster and more efficiently by assisting with text-focused tasks. Within the Notion platform, it performs functions such as content creation, idea development, editing, summarizing, and providing information-based suggestions.

1. In the ICT class, 9th and 10th grade students used Notion AI to prepare a 5-question test on topics such as "artificial intelligence ethics," "creating secure passwords," and "phishing." They

reviewed the accuracy of the questions generated by Notion AI and made the necessary adjustments. They designed a mini knowledge quiz to administer to each other in class.

7.1.9. Autogen

The concept of Autogen is derived from the term "automatic generation" and defines the capacity of generative artificial intelligence to produce content without the need for human intervention. This term specifically refers to text, visual, audio, or data outputs automatically generated by artificial intelligence. The concept of Autogen encompasses not only the process of generating output but also the dynamic, self-organizing, and contextually shaped nature of this process. It is mostly associated with large language models (LLMs) and generative artificial intelligence technologies. These systems produce original and meaningful content based on the inputs provided. The concept signifies a technological transformation in which human input is guiding but not mandatory, and artificial intelligence can autonomously carry out the creative process (Huovinen, 2024).

In line with the autogen approach, teachers worked with students to create posters. These works were prepared using generative artificial intelligence tools (Midjourney, ChatGPT, DALL-E, etc.) to address current issues.
In one activity in particular, students were asked to design a visual representation of individuals who transform the next generation based on socialization theories, while also transforming their own generation.

In this context, it was expected that individuals who do not engage in negative behaviors such as violence, bad language, and fighting, and who can express themselves freely and respectfully without remaining silent, would be represented. The posters prepared highlighted the students' interpretive power and AI-supported narrative skills.

7.2. Teacher-Student Projects

During Science and Technology Week, a video titled "Digital Morning Chat with Hypatia" was created by a math teacher using artificial intelligence tools for visualization and narration. Tools used: ChatGPT, Elevenlabs.

Digital Morning Chat with Hypatia

The game "The Secret of the Infinity Stones," created by a middle school math teacher, with images and text generated by generative artificial intelligence. Tools used: Google Sheets, ChatGPT, Midjourney

The Secret of the Infinity Stones

A game titled "The Mystery of Park Güell," created by middle school teachers, with visuals and text generated by generative AI. Tools used: Canva AI, Google Forms, ChatGPT.

The Mystery of Park Güell

As part of a digital escape game, students use the codes they find at each step to obtain words and compose their own song at the end of the game using the AI-powered content creation tool Udio AI Music. Tools used: Udio, ChatGPT.

Final Step Digital Escape Game

Within the scope of a Turkish language class, images created by 5th-7th grade students using artificial intelligence. Tools used: ChatGPT.

Image 7.2 Characters created by students

As part of a Turkish language class, students were asked to create a poster describing an individual who changes themselves to transform the next generation through socialization theories; someone who is outspoken, active, and able to express themselves freely without resorting to violence or foul language. Tools used: ChatGPT, Dall-E, Midjourney.

In the mathematics course, some works created by 5th-7th grade students using artificial intelligence;

5th Grade: Students created products in the triangles activity. (Tools used: Suno)
5th Grade: Students wrote a play script about triangles. (Tools used: ChatGPT)
6th Grade: Students designed visual and auditory products for measurement units. (Tools used: Canva)
6th Graders: Students composed songs related to the topic using the code words they obtained in a digital escape game. (Tools used: Udio)
7th Graders: Math teachers used the characters from the digital escape game for visual and story design. (Tools used: Google Sites)
7th Graders: Students used the passwords and clues they received on percentages to design a mascot specific to their group. (Tools used: Adobe AI)

7.3. Teacher Feedback and the Impact of This Feedback on Education

Following teachers' interactions with various generative AI tools, the following feedback was received:

1. Student motivation is increasing.
2. Creative thinking is encouraged.
3. It enriches the learning process.

In addition to these positive views, teachers agree that caution is needed regarding information reliability, content accuracy, and ethical use due to the capabilities and capacity of the tools. Some teachers noted that the tools have different effects depending on the grade level; limited and guided use is recommended, especially for students under the age of 13.

In summary, these tools create a new field of activity compared to the learning and teaching activities implemented in previous periods. The power to transform areas of traditional methods that are seen as less compatible and less exciting/fun due to generational change has been recognized.

8. DATA COLLECTION METHODS OF GENERATIVE ARTIFICIAL INTELLIGENCE TOOLS

The use of AI-based tools in educational environments also raises issues of data security and user privacy. The data collection processes of the tools examined in this project have been carefully analyzed. What types of data the tools collect, how this data is stored, and with whom it is shared have been important topics of evaluation.

8.1. Types of Data Collected

Artificial intelligence-based tools collect various categories of data based on user interaction. In general, this data can be classified under the following headings:

1. **Device Information:** Technical information such as the operating system, browser type, device model, and hardware specifications of the device used by the user is collected.
2. **IP Address and Location Data:** IP addresses and connection information are analyzed to determine the user's general geographic location.
3. **Usage Habits:** User interactions within the tools are recorded in the form of data such as correspondence content, created documents, and uploaded files.
4. **User Identity Information:** When users access the tools by creating an account, personally identifiable information such as email address and username is collected.
5. **Cookies:** Data is collected via cookies to personalize the user experience and analyze usage behavior.

The majority of education-focused artificial intelligence tools operate on the principle of collecting user data to a limited extent, whereas platforms developed for commercial purposes may have a much broader scope of data processing.

8.2. Data Storage and Sharing Policies

The vast majority of the AI tools examined store user data in cloud-based systems. However, data sharing policies vary significantly between tools:

Transparency: Some tools explicitly state that user data may be shared with third parties. For example, platforms such as Suno and MidJourney fall into this category.

Data Anonymization: Some platforms process data anonymously to protect user identity. For example, tools such as Claude AI and Adobe Express are applications that prioritize individual privacy.

Data Retention Period: Most of the tools reviewed store user data for a specific period (e.g., 90 days or 1 year) and automatically delete it at the end of this period.
In terms of compliance with Turkish regulations, particularly the "Personal Data Protection Law," local platforms appear to be at an advantage. However, it has been determined that some foreign-based tools do not fully comply with Turkish data protection legislation.

8.3. Age Restrictions and User Policies

Age restrictions are of great importance in terms of data security. Among the artificial intelligence tools examined, age-based access policies vary:

1. **Users under 13 years of age:** Some tools explicitly prohibit use by this age group. For example, OpenAI-based platforms such as ChatGPT and MidJourney prohibit use by individuals under 13 years of age.
2. **Users under 18:** Certain tools impose additional conditions for users in this age group. Conditions such as obtaining parental consent or use under teacher supervision are considered in this context.
3. In this regard, it is important to check age appropriateness when using artificial intelligence tools in school environments and to carefully review and implement relevant user policies.

9. RISK ASSESSMENT FOR ARTIFICIAL INTELLIGENCE USING THE AHP METHOD ASSESSMENT STUDY

This study was conducted to systematically assess the risks that may arise from the use of artificial intelligence tools in educational environments. The research, conducted using the Analytic Hierarchy Process (AHP) method, involved a total of 89 participants from different fields of expertise. The participants consisted of high school (51 people) and middle school (38 people) teachers.

The fundamental risk criteria identified in the study were grouped under the following headings: Pedagogical and Cognitive Risks, Inequality and Access Risks, Ethical and Value-Based Risks, Data Security and Privacy, Artificial Intelligence Generating Incorrect, Incomplete, or Biased Content, Psychological and Social Risks, and Systemic and Societal Impacts. Participants evaluated these criteria using a pairwise comparison method. The data obtained was analyzed using the Eigenvector method, and the consistency of participants' responses was checked using the CR (Consistency Ratio) value. Data with a CR value of 0.10 or below was included in the analysis. The research identified the most pressing risk areas related to the use of artificial intelligence in educational settings.

The widespread use of artificial intelligence tools in education has brought various risk factors to the fore. Therefore, within the scope of the project, it was decided to systematically evaluate the risks that artificial intelligence tools could pose throughout the school using the "Analytic Hierarchy Process (AHP)" method.

9.1. AHP Method: Definition and Scope

The Analytic Hierarchy Process (AHP) is a scientific method used in multi-criteria decision-making problems. This method allows for prioritization among different criteria and enables the decision-making process to be based on objective foundations.

The AHP method was used within the scope of the project for the following purposes:

1. To identify and categorize different types of risks.
2. To determine the relative importance levels of risks.
3. Highlighting the risks with the highest priority in the educational environment.

9.2. Identified Risk Headings

The main risk headings determined in line with the opinions of teachers and the artificial intelligence ethics committee are as follows:

1. **Data Security Breaches:** The risk of student information falling into the hands of malicious individuals.
2. **Child Safety Violations:** The risk of exposure to age-inappropriate content,
3. **Content Accuracy Issues: The risk of** artificial intelligence tools generating incorrect or misleading information,
4. **Unethical Use:** The use of artificial intelligence tools for unethical purposes, such as plagiarism or conduct contrary to academic integrity.
5. **Dependency and Overuse:** Students becoming overly dependent on artificial intelligence and experiencing a decline in productivity,
6. **Copyright Infringements:** The risk of infringing on the rights of others in the content produced.

9.3. AHP Process

The AHP process was implemented in the following steps:

1. **Identification of Criteria:** The risk headings listed above were identified as criteria.
2. **Pairwise Comparisons:** Teachers and committee members rated the relative importance of each risk heading by comparing it pairwise with the others.
3. **Calculation of Weights:** As a result of the comparisons, a weight value was assigned to each risk factor.
4. **Creating a Priority Ranking:** The risks were ranked in order of importance using the weights.

For example, according to the preliminary study results, "Data Security and Child Safety Risks" emerged as the areas with the highest priority.

The data obtained using the Analytical Hierarchy Process (AHP) method applied within the scope of the research is analyzed systematically; teachers' perceptions of risks related to the use of artificial intelligence are evaluated based on their prioritization, consistency levels, and weighted outputs.

9.4. Method

The Analytic Hierarchy Process (AHP), an effective method in decision-making processes, was used in this study. Developed by Saaty in the 1970s, AHP is one of the multi-criteria decision-making methods. AHP allows systematic comparisons at the target, criteria, and alternative levels by dividing complex decision problems into a hierarchical structure. This method is preferred especially when decision elements have both quantitative and qualitative dimensions. In areas requiring multidimensional assessments, such as health, education, engineering, and public policy, AHP provides decision makers with a consistent and traceable analysis framework.
A total of 89 participants were included in our study conducted within this scope. The participants had specific areas of expertise and made pairwise comparisons in line with the defined criteria.

The criteria used in the research are as follows:

1. Pedagogical and Cognitive Risks
2. Inequality and Access Risks
3. Ethical and Value-Based Risks
4. Data Security and Privacy
5. Artificial Intelligence Generating Incorrect, Incomplete, or Biased Content
6. Psychological and Social Risks
7. Systemic and Societal Impacts

Each criterion was weighted using the AHP method, and a priority ranking was obtained. The weights obtained were calculated using the Eigenvector method, and the consistency level of the participants was evaluated using the CR (Consistency Ratio) value.

The sample group was divided into two groups consisting of high school and middle school participants. Fifty-one participants working in high schools and 38 participants working in middle schools filled out the AHP matrices by making pairwise comparisons regarding the criteria mentioned above.

The pairwise comparison matrices created separately for each group were analyzed to determine group-based weightings. The consistency of the participants' responses was checked using the CR value, and data exceeding the CR ≤ 0.10 threshold were excluded from the analysis.

Table 9.1 presents the AHP matrix obtained from the comparisons made by high school teachers as an example.

	PBR	EER	EDR	VGG	YZİ	PSR	STE
PBR	1	3	1	3	5	1	1
EER	1/3	1	1/3	1	1/3	1/3	1/3
EDR	1	3	1	5	5	3	3
VGG	1/3	1	1/5	1	1	1/3	1/3
YZİ	1/5	3	1/5	1	1	1/3	1/3
PSR	1	3	1/3	3	3	1	1/3
STE	1	3	1/3	3	3	3	1

Table 9.1. PBR: Pedagogical and Cognitive Risks, EER: Inequality and Access Risks, EDR: Ethical and Value-Based Risks, VGG: Data Security and Privacy, YZİ: Artificial Intelligence Generating Misleading Content, PSR: Psychological and Social Risks, STE: Systemic and Societal Impacts.

9.5. Consistency Ratio (CR) Analysis

The Consistency Ratio (CR) value was calculated to measure the consistency of each participant's comparisons. The CR value indicates the degree of consistency in the participant's comparisons, and a CR ≤ 0.10 value is considered an acceptable level of consistency.

In the analysis conducted for high school participants, the CR value of 4 participants was found to be greater than 0.10. This indicates that there are inconsistencies in the pairwise comparisons of the relevant participants and that the reliability of the priority values obtained may be weakened. Therefore, the data of these participants were excluded from the analysis or evaluated separately.

In the evaluation conducted for middle school participants, none of the participants recorded a CR value above 0.10. This indicates that the comparisons made by middle school participants were generally consistent and increased the reliability of the results obtained.

9.6. Evaluation

In light of the CR values, it was observed that the data obtained from the middle school group had a higher consistency compared to the high school group.

In addition, the weights given by teachers to the seven criteria identified for their risk perceptions regarding artificial intelligence were analyzed. The individual weight vectors of each of the 47 teachers working at the high school level were calculated. The weights obtained were combined to calculate the average weight value for each criterion.

Figure 9.1 presents a comparative analysis of the importance levels of the criteria according to high school teachers' evaluations. An examination of the data in Figure 9.1 and Table 9.2 reveals that the Pedagogical and Cognitive Risks (0.3233) criterion has a significantly higher weight than the others. This finding shows that teachers are most concerned about the effects of AI use on learning processes and cognitive development. Inequality and Access Risks and Ethical and Value-Based Risks rank second and third, reflecting teachers' sensitivity to issues of fairness, values, and access.

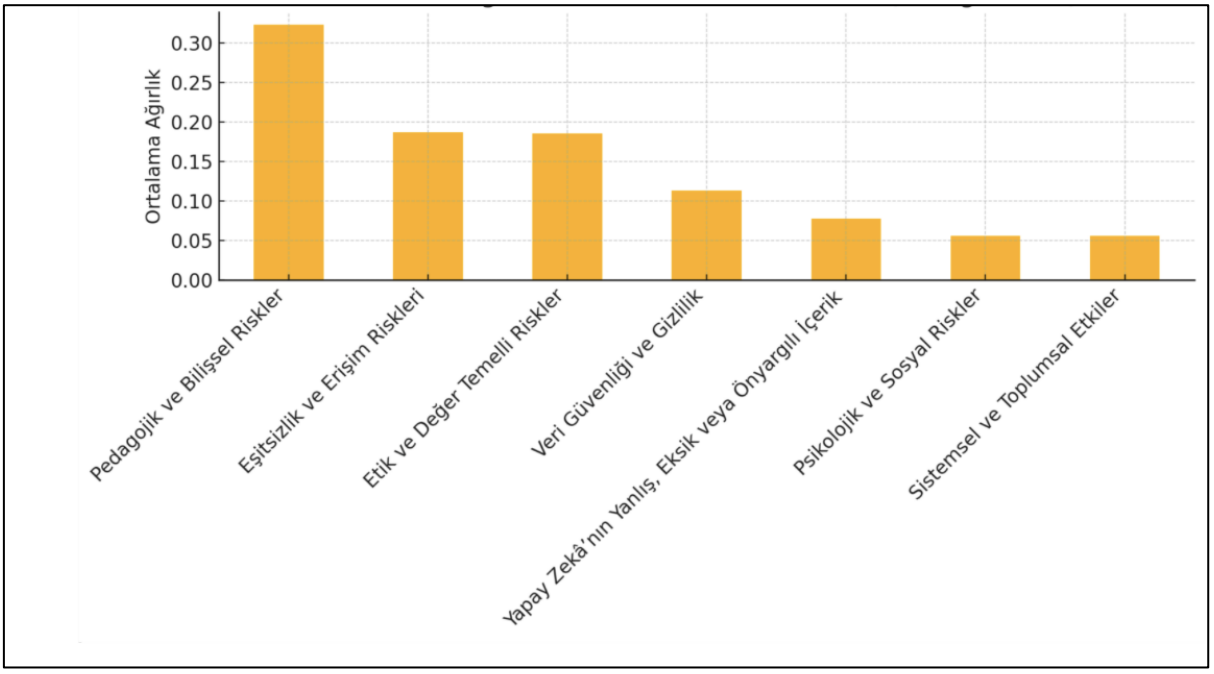


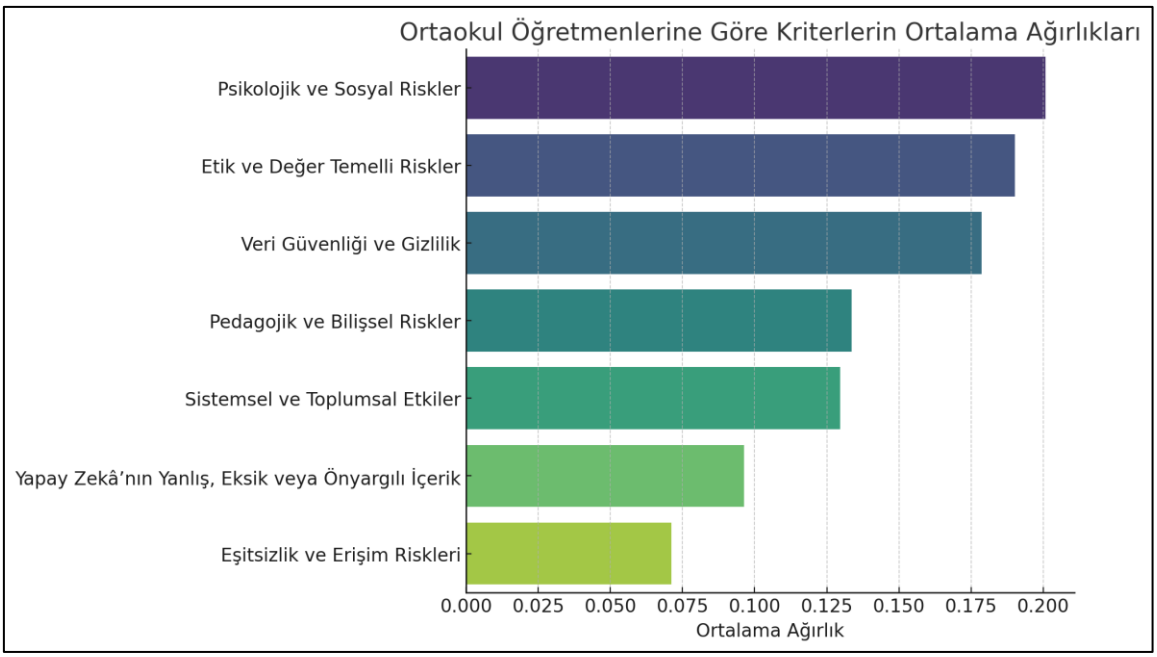
Figure 9.1. Criteria Prioritization Chart Created with AHP Weights.

Kriter	Ortalama Ağırlık
Pedagojik ve Bilişsel Riskler	0.3233
Eşitsizlik ve Erişim Riskleri	0.1873
Etik ve Değer Temelli Riskler	0.1856
Veri Güvenliği ve Gizlilik	0.1129
Yapay Zekâ'nın Yanlış, Eksik veya Önyargılı İçerik Oluşturması	0.0778
Psikolojik ve Sosyal Riskler	0.0562
Sistemsel ve Toplumsal Etkiler	0.0562

Table 9.2. Average weights assigned by high school teachers to risk criteria related to artificial intelligence.

Graph 9.2 presents a comparative overview of the average importance levels assigned by middle school teachers to risk categories related to artificial intelligence. When Graph 9.2 and Table 9.3 are examined together, it is seen that the categories "Psychological and Social Risks (0.201)" and "Ethical and Value-Based Risks (0.190)" stand out with the highest average weights. This result reveals that teachers consider the effects of artificial intelligence technologies on student

psychology and ethical and value education to be relatively more important. In contrast, the lowest average weight was calculated for the "Incorrect, Incomplete, or Biased Content of Artificial Intelligence" category. This indicates that teachers consider risks related to such content to be less critical compared to other categories.



Graph 9.2. Criteria Prioritization Graph Created with AHP Weights.

Kriter	Ortalama Ağırlık
Psikolojik ve Sosyal Riskler	0.2008
Etik ve Değer Temelli Riskler	0.1901
Veri Güvenliği ve Gizlilik	0.1786
Pedagojik ve Bilişsel Riskler	0.1335
Sistemsel ve Toplumsal Etkiler	0.1296
Yapay Zekâ'nın Yanlış, Eksik veya Önyargılı İçerik	0.0963
Eşitsizlik ve Erişim Riskleri	0.0711

Table 9.3. Average weights assigned by middle school teachers to risk criteria related to artificial intelligence.

9.7. AHP Evaluation Results and Recommendations

The evaluation conducted using the Analytic Hierarchy Process (AHP) revealed that teachers perceive the risks associated with the use of artificial intelligence in educational environments with different priorities. High school teachers, by assigning a high weight (0.3233) to the Pedagogical and Cognitive Risks category in particular, viewed the possible negative effects of artificial intelligence tools on students' learning processes and cognitive development as the most critical risk. In contrast, middle school teachers highlighted Psychological and Social Risks (0.201) and Ethical and Value-Based Risks (0.190), focusing more on values education, social adaptation, and psychological effects in line with students' developmental characteristics. This differentiation shows that teachers' perceptions vary according to age groups and that a multidimensional approach is necessary in the policy-making process.

The AHP results also showed that **Data Security and Child Safety** risks were critically important in both groups. This finding emphasizes that protecting students' personal information and ensuring they encounter age-appropriate content should be a fundamental priority in educational settings. The recommendations developed within this framework can be summarized as follows:

1. **Data security and age appropriateness controls should be a priority.** The protection of student information and the strengthening of content filtering systems should be mandatory in all artificial intelligence applications.
2. **Strict enforcement of ethical usage rules is required.** Preventive policies should be established against unethical usage such as plagiarism, academic dishonesty, or copyright infringement, and a culture of academic integrity should be fostered among students.
3. **Teacher guidance should be increased, and students' conscious use of technology should be supported.** Teachers' guiding role is critical to prevent students from becoming dependent on artificial intelligence tools and to strengthen their critical thinking skills.
4. **Risk assessments should be updated periodically.** Due to the rapid development of artificial intelligence technologies, AHP-based risk analyses should be repeated at regular intervals, and preliminary assessments should be conducted when new technologies are introduced.

In conclusion, the findings obtained with AHP show that risks related to AI integration in educational environments are dynamic, multidimensional, and require continuous monitoring. Therefore, the recommended measures offer a proactive framework not only to reduce current risks but also to prepare for future technological developments.

10. CONCLUSION

The world, which has witnessed the transitions of many species, is accompanying the journey of the most dominant species, humanity, into a new era. Humanity, which does not hesitate to otherize its own species in terms of language, religion, race, and gender, is it on the verge of a new test of otherization with artificial intelligence? Or does it feel fear that it will become physically and cognitively obsolete, useless, and devalued as everything that made it valuable is pushed into the background with the emergence of a more intelligent species?

The Açı Schools Artificial Intelligence Policy Document is the outcome of the Artificial Intelligence Ethics Committee, launched in 2024 to include teachers from all levels of the school. The document aims to provide a comprehensive understanding of artificial intelligence and to present the results of the collaboration between artificial intelligence and teachers, along with points to consider. Prepared with great dedication by Açı Schools, this policy document asks questions about this mistake and fear that humanity is accustomed to and does not hesitate to repeat, and attempts to provide answers to these questions by compiling information from various fields, ranging from historical development to current practices, ethical and legal dimensions to data security.
The journey of artificial intelligence has been conveyed throughout history, from ancient times to the important figures who have left their mark on human history. Within this transmission, the types of artificial intelligence we are dealing with are explained alongside the concepts of Artificial Narrow Intelligence (ANI), Generative Artificial Intelligence (GAI), Artificial General Intelligence (AGI), and Artificial Super Intelligence (ASI), and the architecture, application areas, and effects of generative artificial intelligence (GAI) are detailed.

In addition to the types, the journey of countries with artificial intelligence, their strategies, and their desired national policies regarding education are conveyed. Specifically for our country, the "National Artificial Intelligence Strategy Document," which was published for the first time, also addresses the activities of NGOs that have made significant contributions to shaping the public's perception of artificial intelligence.

The document conveys the effects of artificial intelligence in the field of education, primarily through personalized learning, instructional systems, expert systems, and chatbots; it includes concrete examples of the application of generative artificial intelligence tools (Gamma AI, ChatGPT, Claude, Suno, Leonardo AI, etc.) at Açı Schools. Projects that develop students' creativity and the role of artificial intelligence in teachers' planning and content development processes are detailed. However, ethical and pedagogical risks associated with the use of artificial intelligence have also been evaluated; and the negative effects on individuals and society have been addressed in terms of brain rot, hallucination, confabulation, addictive intelligence, bias, disinformation, information pollution, and misinformation. Solutions such as transparency, data protection, ethical codes, the use of diverse data sets, explainable artificial intelligence, and stakeholder participation have been proposed to mitigate these risks.

Generative artificial intelligence technologies will undoubtedly shape social life, children's processes, and the world of education. In this journey of shaping, rather than resorting to the reflex of "ban, dismiss, ignore," it is necessary to understand more, set measurable goals, draw clear responsibility frameworks , and establish transparent communication. These are the first steps for both educational institutions and families to work together to discover opportunities and reduce risks.

Based on this policy document, the following steps can be recommended to education stakeholders who wish to implement this process in their schools:

1. Establish guiding principles
    a. Purposefulness: Do not think of generative AI technologies in terms of results; examine the potential of these tools to make thinking visible and set goals that break down from general to specific.

b. Transparency: Be open with all education stakeholders about the opportunities and threats these technologies present. Provide periodic feedback on what should be done, how, and to what extent. As this is an evolving technology, the initial opportunities and threats may change.
c. Ethics and Fairness: Artificial intelligence has problematic cases in terms of ethics and impartiality. The reflections of these cases in the education community are minimal. However, this does not mean that they will never occur. Therefore, discuss and identify situations that could undermine school ethics and fairness.
d. Privacy and Security: Establish a general understanding of privacy and security, as well as an understanding of privacy and security based on demographic characteristics. Pay attention to the principle of minimum data sharing and maximum anonymization for any application whose backup and server are not located in our country.
e. Traceability: Do not stop monitoring every application you bring in and every application you develop.
f. Competency: As productive artificial intelligence technologies continue to evolve, new competencies will emerge and existing competencies will need to be updated. Plan and manage this competency shift not with immediate solutions, but as a process that will be rolled out across the board.

2. Measurable Goals
    a. Teacher Competency: At the beginning of the year, determine what percentage of teachers in which subjects will gain tool competency.
    b. Tool Integration: Select how many of the nearly 200 million primary and secondary artificial intelligence tools you will examine.
    c. Parent Information: Decide how many regular Q&A sessions and information panels you will organize regarding the potential of the tools included and the applications developed.
    d. KPI: Clarify the KPIs that will allow you to monitor and report on your school culture and productive artificial intelligence.
3. Purchasing and technology selection (Before incorporating a tool into school processes, ask the following questions.)

a. Is it aligned with learning outcomes and can it be aligned? Are there supports such as rubrics, and are they adaptable?
b. Where does it store data and how does it process it?
c. Is it age-appropriate? Can it be modified in this way?
d. Are error reporting, ethical, and accessibility standards clear?
e. Is language support sufficient?
f. What other applications does it communicate with?
g. What is the relationship between the cost of ownership and measurable educational gains?

The future of generative artificial intelligence in education depends on a shared understanding built by all stakeholders. This policy document was created in an effort to move beyond the question "Should it be used?" and provide a systematic answer to the question "How should it be used to be beneficial?"

Developed at Açı Schools, this policy embraces technological transformation with a human-centered, ethical, and education-focused approach, contributing to equipping students with 21st-century skills and fostering a culture of continuous improvement in education.

The Açı Schools Corporate Artificial Intelligence Policy Document will be evaluated and updated at the beginning of each academic year by the Artificial Intelligence Policy

Committee at the beginning of each academic year.

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