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Learning about Climate Change through Artificial Intelligence

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Contents

Chapter 1

Objectives of Chapter 1

The structure of Chapter 1 aims to give participants a complete picture of the rapid development of Artificial Intelligence (AI) in recent years, as well as the possibilities offered to users by the most well-known AI tools and how they can be utilised.

After completing Chapter1, readers should be able to:

- Clearly define what AI is and what Generative AI (GenAI) is, and explain their basic differences/similarities.
- Describe the evolution of AI since Turing, identifying key historical moments.
- Explain what Large Language Models (LLMs) are, how they work (e.g. transformers) and what kinds of tasks they are used for, as well as their limitations.
- Distinguish between types of chatbots (rule-based, AI-powered, hybrid, livechat) and their basic building blocks (NLP/ML).
- Evaluate the benefits/added value of chatbots (service, cost, productivity, personalisation).
- Describe how GenAI works (data training, new content production) and its indicative applications.
- Recognise ethical issues and principles (fairness/equality, transparency, human oversight) governing the responsible use of AI.
- Be familiar with basic principles of privacy/data protection (GDPR) and the right to human intervention (Article 22).
- Summarise the European regulatory/legal framework and relevant initiatives for AI.
- Compare historical chatbots (e.g. ELIZA, PARRY, A.L.I.C.E.) with modern systems (e.g. ChatGPT) in terms of capabilities/limitations.
- Identify risks of misinformation/privacy (e.g. deepfakes) and propose mitigation measures.
- Translate the above principles into classroom practices and cultivate a culture of respect for privacy.

Introduction

Human evolution from ancient times to the present day has been characterised by the effort to become more creative and productive, with the aim of achieving better living conditions.

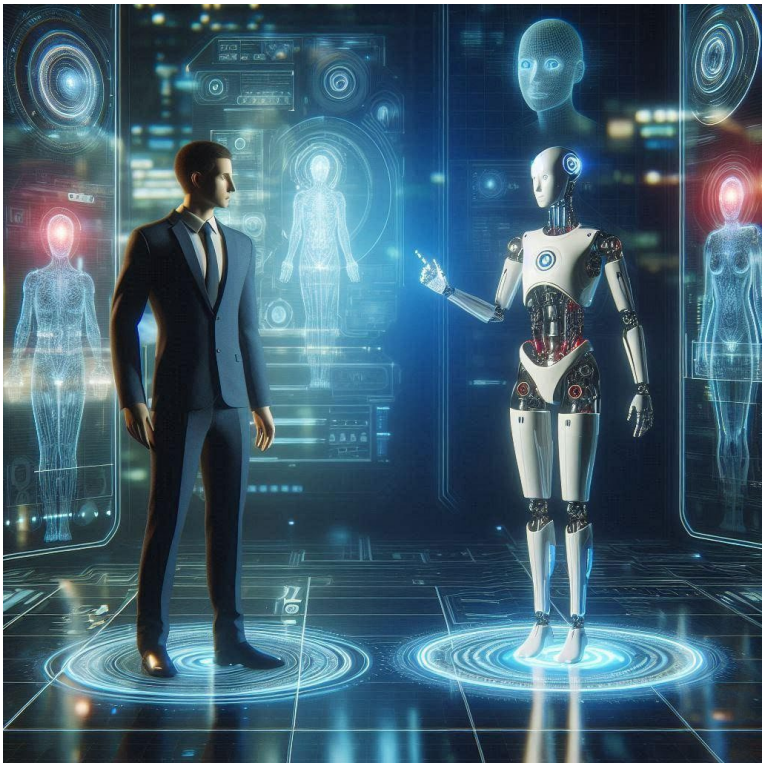
The further back we go in human history, the more we discover "steps of evolution" such as the use of stone tools, later the use of metal tools, or the use of fire, the discovery of the wheel and its use in various applications of everyday life, etc. But even in more recent history, the use of scientific achievements and their application in everyday life has brought about major changes in the functioning of human communities, improving living conditions and greatly increasing life expectancy.

In the last century, the discovery and use of computers has brought about tremendous changes in the simplest human actions as well as the most complex actions and applications, in a period of just over 75 years, with the latest development being Artificial Intelligence (AI).

During these 75 years, developments have been rapid. In the brief description of the changes we have recorded since 1950, everyone can see the speed of developments to date and possibly predict what might follow in the coming years.

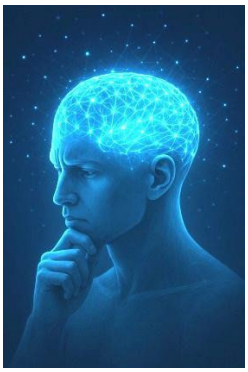
1.1 The Evolutionary Course of Artificial Intelligence

1950 - Alan Turing publishes the seminal article "Computing Machinery and Intelligence". He discusses how to build intelligent machines and test their intelligence. He proposes the so-called Touring Test, which is a test of a machine's ability to exhibit intelligent behaviour equivalent to that of a human being. Essentially, if you cannot tell that you are chatting with a chatbot today and believe that you are chatting with a human being, then we say that the chatbot passes the Touring Test.



https://www.google.com/url;sa=t&source=web&rct=j&opi=89978449&url=https://en.wikipedia.org/wiki/Alan_Turing&ved=2ahUKEwj4246K1MGPAxXURPEDHUhDODYQFnoECB0QAQ&usg=AOvVaw0zl9L_kugoSJAGrPejvhD0

1955 - The term "Artificial Intelligence" (AI) is invented.
1956 - Dartmouth's summer research programme on Artificial Intelligence marks the birth of artificial intelligence as a field of study.



AI Magazine Volume 27 Number 4 (2000) (© AAA)

A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence
31 August 1955

John McCarthy, Marvin L. Minsky, Nathaniel Rochester,

and Claude E. Shannon

Between 1957 and 1974, AI flourished. Computers improved and could now store more information. They became faster, cheaper and more accessible. Machine learning algorithms were created and researchers began to familiarise themselves with their use.

1957 - The Perceptron, an early artificial neural network that enables pattern recognition, is developed.

1961 - Unimation introduces the first robot designed for industrial use.

1963 - **MIT** develops the first neural network learning machine.

1966 - The ELIZA programme is developed, which can provide a range of services such as the following:

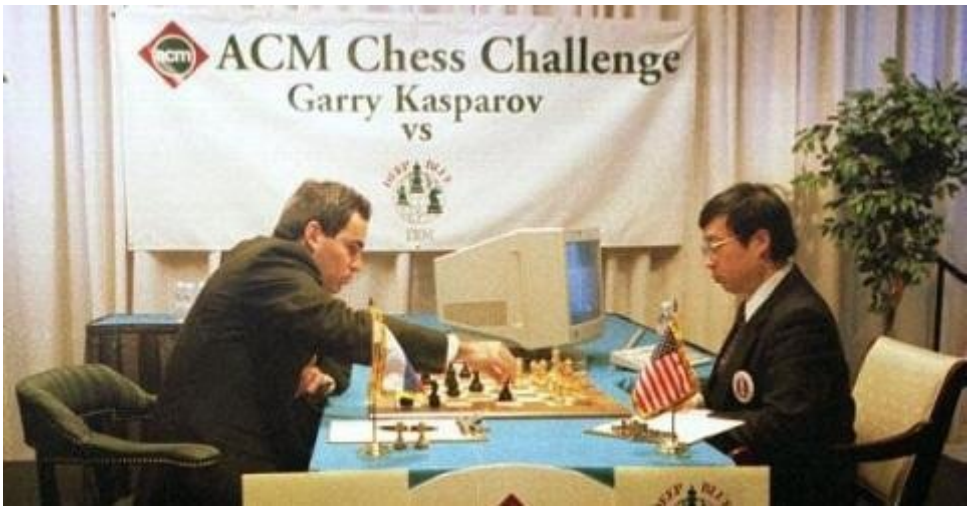
It can imitate a therapist and converse in English

https://www.youtube.com/results;search_query=eliza+computer+program

welcome to

Eliza is a mock Rogerian psychotherapist.
The original programme was described by Joseph Weizenbaum in 1966.
This implementation by Norbert Landsteiner 2005.

ELIZA: Is something troubling you?
YOU: Men are all alike.
ELIZA: What is the connection, do you suppose?
YOU: They're always bugging us about something or other.
ELIZA: Can you think of a specific example?
YOU: Well, my boyfriend made me come here.
ELIZA: Is it important to you that your boyfriend made you come here?
YOU: He says I'm depressed much of the time.
ELIZA: I am sorry to hear that you are depressed.
YOU: It's true. I am unhappy.
ELIZA: Can you explain what made you unhappy?



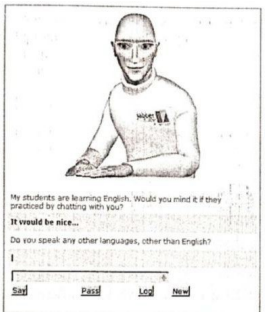
Kasparov versus Deep Blue

1970 - The first humanoid robot, WABOT-1, is built at Waseda University in Japan. It consists of a limb control system, a vision system and a conversation system.
https://www.humanoid.waseda.ac.jp/booklet/kato_2.html

1988 - Judea Pearl publishes "Probabilistic Reasoning in Intelligent Systems". He is credited with the invention of Bayesian networks. This work revolutionises the field of Artificial Intelligence and many other branches of Engineering and Physical Sciences.

1988 - O'Rollo Carpenter develops the chatbot Jabberwacky. The goal is to "simulate the human conversation in an interesting, entertaining and humorous way." This is an early attempt to create artificial intelligence through human
https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=http://www.jabberwacky.com/chat-psylon&ved=2ahUKEwjCm4rHkNmTAxXPgf0HHb53JScQFnoECBsQAQ&usg=AOvVaw2EtOZwRNmMQPbYlvOAuyl3

1991 - The emergence of the internet makes it possible to share data regardless of who the user is. Considering that data is the fuel for artificial intelligence, this is a pivotal moment for artificial intelligence.



1995 The chatbot A.L.I.C.E. (Artificial Linguistic Internet Computer Entity) is developed. It involves the collection of natural language sample data on an unprecedented scale, made possible by the internet.

https://en.wikipedia.org/wiki/Artificial_Linguistic_Internet_Computer_Entity

1997 - IBM's Deep Blue defeats world chess champion Garry Kasparov in a six-game match.
https://en.wikipedia.org/wiki/Deep_Blue_versus_Garry_Kasparov

1998 1999 - Sony introduces the AIBO robot dog, one of the first entertainment robots. https://us.aibo.com/. Google launches the first commercial search engine. Artificial intelligence is used to improve search results.

2000 - Cynthia Breazeal of MIT develops Kismet, a robot that can recognize and simulate emotions. https://en.wikipedia.org/wiki/Kismet_(robot)

2009 – Computer scientists at Northwestern University develop Stats Monkey. This is a programme that writes sports news without human intervention. http://www.apstatsmonkey.com/

2010 marks the beginning of the era of Deep Learning in artificial intelligence. Graphics processors such as Nvidia GPUs begin to be used to train Deep Learning models. These will subsequently form the core of machine learning and revolutionise the development of artificial intelligence. https://www.zdnet.com/article/how-the-gpu-became-the-heart-of-AI-and-machine-learning/

In the **2010s**, two factors came into play that completely transformed artificial intelligence: enormous computing power from graphics processing units and huge amounts of data collected from the internet. Today's generative artificial intelligence models require thousands of GPUs to run. OpenAI used 10,000 Nvidia GPUs to train ChatGPT. https://www.techspot.com/news/97919-chatgpt-possible-due-tens-thousands- nvidia-gpus-which.html

2011 - IBM's Watson, a computer that answers natural language questions, competes on Jeopardy! It defeats two former champions. Jeopardy! is an American television game show that reverses the traditional question-and-answer format. Instead of being asked questions, contestants are given pieces of general knowledge in the form of answers and must identify the person, place, thing or idea described by the piece of information, phrasing each answer in the form of a question. This demonstrates Watson's capabilities for synthesis and analysis. https://www.youtube.com/watch?v=NZy1GDcuxa

2015 - OpenAI is founded as a non-profit organisation by Elon Musk, Sam Altman, Reid Hoffman, Jessica Livingston and others. Their mission is to spend $1 billion to keep humanity safe from "bad" artificial intelligence. Musk later withdraws from the agreement and OpenAI takes on corporate investors, resulting in a change of course. https://www.semafor.com/article/03/24/2023/the-secret-history-of-elon-musk-sam-altman-and-openAI

2018 - LLMs (Large Language Models) emerge. LLMs are a type of artificial intelligence system trained on enormous amounts of text data. They can understand natural language and generate responses that resemble human answers. LLMs use advanced machine-learning algorithms to understand and analyze human speech. They are used for chatbots, virtual assistants, language translation, content creation, and scientific research. https://www.topbots.com/leading-nlp-language-models-2020/

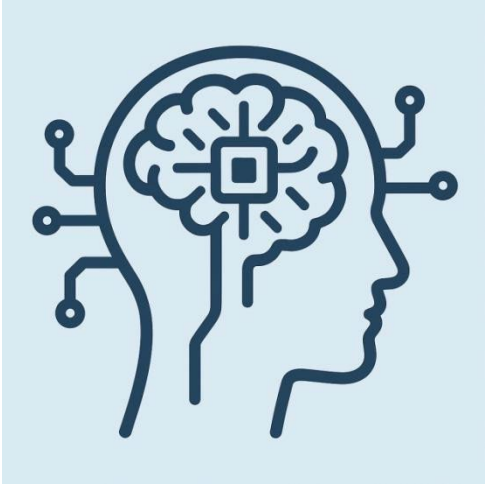
2018 - OpenAI introduces GPT (Generative Pre-trained Transformer). This becomes one of the most important discoveries in natural language processing.

30 November 2022 - OpenAI launches ChatGPT, a chatbot built on the large language models GPT-3.5 and GPT-4. ChatGPT generates human-like text based on user prompts. It predicts the next word in a given text based on patterns it has learned from a huge amount of data during its training process. When you ask ChatGPT a question, it uses "transformative architecture" to respond.

This is a Deep Learning technique (a branch of machine learning) that processes terabytes of data containing billions of words to generate a response.
4 December 2022 - ChatGPT reaches 1 million users.
January 2023 - ChatGPT reaches 100 million monthly active users. It becomes the "fastest growing consumer application in history."
2 March 2023 - More than 1,000 artificial intelligence scientists sign an open letter. They argue that "artificial intelligence systems with human-competitive intelligence could pose serious risks to society and humanity." They call for a pause in the development of systems more powerful than GPT-4.

1.2 AI and GenAI (reference to AItechnologies)

a) Artificial Intelligence (AI)



In recent years, many definitions of artificial intelligence have been given. For example:
According to Russell S.J. and Norvig P. (2010), Artificial Intelligence is the art of creating and studying computational machines that perceive, reason, act and perform functions that require intelligence. According to Kolbjørnsrud V. and his colleagues (2016), artificial intelligence refers to multiple technologies that enable computers to sense and perceive the world, analyse and understand the information collected, learn from experience, make decisions, and provide recommendations.
According to the UK Government Digital Service and the Office for Artificial Intelligence (2019), Artificial Intelligence is a field of research that includes logic, philosophy, linguistics, psychology, mathematics, economics, computer science, and neuroscience, and that uses digital technologies capable of performing tasks that normally require intelligence.
Finally, in 2019, the European Commission's Expert Group on Artificial Intelligence and the OECD proposed updated definitions that apply to all sectors and have been accepted by national governments around the world.
According to the OECD (2019), "AI is a machine-based system that can, for human-defined objectives, make predictions, recommendations or take decisions that affect real or virtual environments. It uses mechanical and human-centred inputs to perceive environments, abstract unified and specific perceptions, into models in an automated or manual way and use the conclusions of the models to form options for information or actions. AI systems are designed to operate with varying levels of autonomy.
Artificial intelligence is an advanced technology, which is usually performed by a series of algorithms, computers or robots. It also uses real-time data to simulate human intelligence.
It can reproduce human thought and make decisions. In other words, it is programmed to think, act and respond just like a living human being.
However, it should not be confused with automation. Automation, like AI, uses real-time data to perform a function. However, the mechanisms and the result are very different.

For example, automation requires manual data entry to perform a task. The task will be repeated regardless of what the data says or whether there is an error. In contrast, artificial intelligence is machine learning. This means that it requires data entry, but as it processes the data, it can recognise errors. It can then adjust its functions and algorithms as needed, thus avoiding potential errors.

Artificial Intelligence (AI) can help humans in many areas because:

1. It reduces human error

Let's face it, sometimes people make mistakes. The good thing about making mistakes is that we usually learn from them.

AI works in the same way. While acting and performing like a human, it can greatly reduce errors. This helps us understand all possible outcomes and choose the most appropriate one.

By using data and predictions, we can better understand our options, the outcomes, and the implications of those outcomes. This is particularly useful for businesses. Decision-makers can consider all the possibilities before taking action.

2. It helps with research and data analysis

Another advantage is the use of technology for research and data analysis. AI technologies are intelligent and can collect the necessary information and make predictions in a matter of minutes.

What would normally take a person months of research can now be done in significantly less time. The data collected by AI and the analysis performed are invaluable. You can use this information in collaboration with data analysts.

3. It can make unbiased, intelligent decisions

With the right data, artificial intelligence removes bias from decision making. You can achieve the best results by using it. However, you must ensure that specific information and the most accurate data set are entered.

When it has and processes the best data, it can accurately predict results, solve problems, and perform functions correctly. However, if the data you feed into the programmes is flawed, you will likely get a biased result. Be sure to check it for possible interactions.

4. Performs repetitive tasks

Don't forget: automation and AI are different technologies. However, artificial intelligence can function as an advanced version of automation. It can be used to perform repetitive tasks and suggest alternative results. Most importantly, users gain more time to deal with other, more complex issues.

For example, it can be integrated with a chatbot on your website. It is well known that a chatbot may not provide human contact when interacting with potential customers. Combining it with AI can initiate processes and attract the customers you were looking for.

Another example is that it can help a prospective customer start a search. It can gather information about potential prospects and behavioural data, which can be entered into your CRM (Customer Relationship Management) for later review.

b) Generative AI (GenAI): Productive Artificial Intelligence

Generative A.I. or **Generative Artificial Intelligence** (pronounced *Generative AI*, also abbreviated as GenAI or GAI **and Generative AI**), is a type of artificial intelligence capable of producing text, images, videos, or other data using generative models, often in response to prompts. Generative artificial intelligence models learn the patterns and structure of their input training data and then generate new data with similar characteristics.

Improvements in deep neural networks based on machine learning transformers, and especially in LLMs, enabled the rise of generative artificial intelligence systems in the early 2020s. These include chatbots such as ChatGPT, DeepSeek, Grok, Gemini, Claude, Microsoft Copilot, Qwen and LLaMA (MetaAI), artificial intelligence image generation systems (text-to-image) such as Stable Diffusion, Midjourney and DALL-E, and video generation systems (text-to-video) such as Sora. Companies such as OpenAI, Anthropic, Microsoft, Google, Meta, Alibaba, xAI, DeepSeek, and Baidu, as well as many smaller companies, have developed Generative AI models.

Generative AI has uses in a wide range of applications, including software development, healthcare, finance, entertainment, customer service, sales and marketing, and educational programmes in art, writing, fashion, and product design.

However, concerns have been raised about the potential misuse of Generative AI, such as cybercrime, the use of fake news or deepfakes to deceive or manipulate people, and the mass replacement of human jobs. There are also concerns about copyright law surrounding generative models that are trained on and mimic copyrighted works of art.

The terms "generative AI planning" and "generative planning" were used in the 1980s and 1990s and refer to artificial intelligence planning systems, especially computer-aided process planning, used to generate sequences of actions to achieve a specific goal.AI planning systems used symbolic AI methods and were a "relatively mature" technology in the early 1990s.

They were used to generate crisis action plans for military use, process plans for the construction of decision-making plans, such as in the prototype autonomous spacecraft.

Artificial intelligence applications have social implications and generate intense controversy and concern.

A key concern is job loss. Since the early days of artificial intelligence development, arguments have been put forward by ELIZA creator Joseph Weizenbaum and others about whether tasks that can be performed by computers should actually be done by them, given the difference between computers and humans, and between quantitative calculations and qualitative, value-based judgements.

In April 2023, it was reported that artificial intelligence image generation had led to the loss of 70% of video game illustrator jobs in China.

In July 2023, developments in generative artificial intelligence contributed to the 2023 labour disputes in Hollywood. Fran Drescher, president of the Screen Actors Guild of the United States, stated that "*artificial intelligence is an existential threat to creative professions*" during the 2023 SAG-AFTRA strike. AI voice production has been seen as a potential challenge to the voice acting industry.

The controversy surrounding artificial intelligence and concerns about employment among affected groups worldwide remains a critical aspect. While AI promises improvements in performance and skill acquisition, concerns about job retention and existing hiring processes persist among these groups, as described in research by Fast Company.

To leverage AI technologies for a more equitable society, preventive measures include mitigating biases, promoting transparency, respecting privacy and consent, and adopting an ethical mindset. Strategies involve shifting policy toward the concept of regulation, embracing inclusive design, and enabling education to offer personalized teaching, with the aim of maximizing benefits and minimizing harm.

Concerns also arise from “deep fakes” as a result of technological advances, which appear in the form of video and audio.

Deepfakes are AI-generated media that take a person in an existing image or video and replace them with someone else’s likeness using neural networks. Deepfakes have gained widespread attention and concern due to their use in celebrity deepfake pornography, revenge porn, fake news and misinformation, financial fraud, and third-party election interference. These issues have prompted responses from both industry and government to detect and limit their use.

Cases of users misusing software to produce controversial statements with voices nearly identical to those of public officials and other famous individuals have also raised ethical concerns regarding AI-generated voice. In response, companies such as Eleven Labs have stated that they will work to reduce potential misuse through safeguards and identity verification.

Concerns have also arisen from the music created by AI. The same software used for voice cloning has been used on the voices of famous musicians to create songs that mimic their voices, gaining both huge popularity and criticism. Similar techniques have also been used to create improved quality or full-length versions of songs that have been leaked or have not yet been released.

Generative Artificial Intelligence has also been used to create new digital artistic personalities, with some of them receiving enough attention to produce albums from major labels. The developers of these virtual artists have also faced criticism for their personified programmes, including backlash for "dehumanising" an art form, as well as creating artists who make unrealistic or unethical promises to their audience.

Finally, the development of Artificial Intelligence also has negative effects and creates criminal activity in cyberspace. The ability of Generative AI to create realistic fake content has been exploited in many types of cybercrime, including phishing scams.Deepfake videos and audio recordings have been used to create misinformation and fraud.

Former Google fraud chief Shubhan Goshamayumder has predicted that while deepfake videos initially caused a stir in the media, they will soon become commonplace and more dangerous.

In addition, large language models and other forms of generative text AI have been used to create fake reviews on e-commerce websites to boost ratings. Cybercriminals have created large language models focused on fraud, including WormGPT and FraudGPT.

Research conducted in 2023 revealed that generative artificial intelligence has weaknesses that can be exploited by criminals to extract harmful information, bypassing ethical safeguards. The study presents examples of attacks carried out on ChatGPT, including jailbreaks and reverse psychology. Furthermore, malicious individuals can use ChatGPT for social engineering and phishing attacks, revealing the harmful side of these technologies.

1.3 Large Language Models (LLMs)

LLMs are artificial intelligence systems based on very large volumes of data with the aim of understanding human communication and predicting the next word in a sentence based on the previous words in the same sentence.

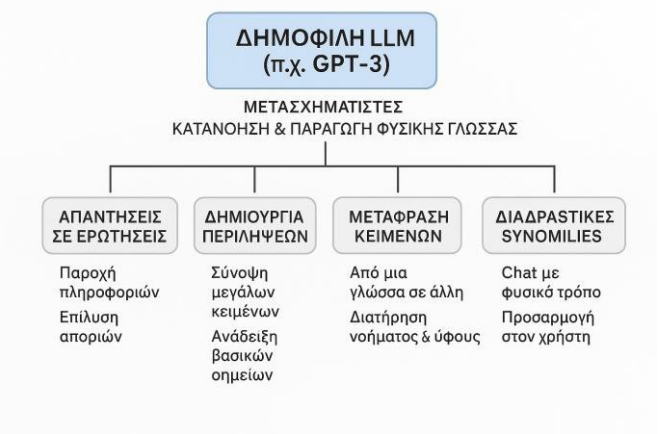
These systems are used in writing papers on specific topics, writing simple texts, translations, answering specific questions, etc.

LLM systems can perform the functions described above without understanding the content of the text, but based solely on statistical patterns, often resulting in incorrect or misleading information.

Electronic devices that support LLM systems must have high computing power to function satisfactorily.

This extensive infrastructure enables LLMs to understand the nuances of language, grammar, and certain aspects of general knowledge.

grammar, and certain aspects of general knowledge.



Some popular LLMs, such as OpenAI's GPT-3, use a type of neural network called a transformer, which allows them to handle complex linguistic tasks with remarkable proficiency, and can perform a wide range of tasks, such as:

- Answering questions
- Creating text summaries
- Translating texts
- Creating lists of text content
- Engaging in interactive conversations with users

As LLMs continue to evolve, they have great potential for improving and automating various applications across all industries, from customer service and content creation to education and research.

However, they raise ethical and social concerns, such as biased behaviour or misuse, which must be addressed as the technology advances.

Key factors for creating a functional LLM model system are as follows:

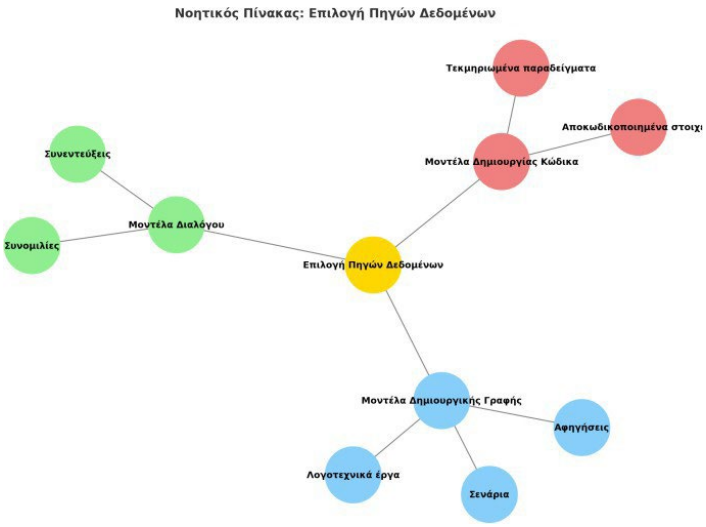
1. **Prioritise data quality over quantity** A large dataset is fundamental to language model development. However, there is a strong correlation with data quality. Models developed on extensive but poorly structured data may yield inaccurate results.

Conversely, smaller, carefully curated datasets often lead to higher quality results. This reality highlights the importance of a balanced approach to data collection. Data must be diverse and relevant to the intended scope of the model, requiring careful selection and organisation.

2. **Selecting Appropriate Data Sources**

The selection of data sources must align with the specific application goals of the model.

- Models designed for generating dialogue require sources such as conversations and interviews.
- Models focused on code generation require well-documented and fully decoded materials.
- Literary works and scripts provide rich training material for those aiming at creative writing.



In general, you should include data that covers the intended languages and topics. This helps you tailor the model so that it performs effectively within its designated domain.

1.4 Chatbots (What they are, their history, how they work today)

1.4.1 Definition of Chatbot

Chatbots are computer programs designed to simulate conversations with people, mainly through written text, but also vocally in more advanced forms. They use technologies such as artificial intelligence (AI), natural language processing (NLP) and machine learning (ML) to understand and respond to user requests. Their purpose is to answer questions, provide information, perform tasks based on commands, and automate processes.

Chatbots are a powerful technological application that provides the possibility for faster communication, and automation and management of complex requests.

1.4.2 A brief overview of the history of chatbots

The history of chatbots began about 60 years ago. Since then, they have evolved rapidly. The main milestones in their development are:

- 1966. The first chatbot was ELIZA, created by Joseph Weizenbaum at MIT. It simulated a psychotherapist and answered questions based on the words typed by the user.

ChatGPT is the current evolution of Chatbot and is the advanced cognitive form of ELIZA. Weizenbaum wrote in 1966 that ELIZA made certain types of conversation in natural language between humans and computer possible. In the 1960s, the technology that supported ELIZA was primitive compared to today's reality.

-1972. PARRY was developed by psychiatrist Kenneth Colby and attempted to mimic someone with schizophrenia.
- **1980-1990**. Chatbots appear in video games and research projects.
- **2000.** More advanced bots are created, such as A.L.I.C.E. (Artificial Linguistic Internet Computer Entity).
-2010. Digital assistants such as Siri (Apple), Google Assistant and Alexa (Amazon) appear.
-2020. With the development of LLMs such as GPT, chatbots become more flexible. The evolution of bots raises many questions, the answers of which can range from pleasant to frightening. Is it possible for a computer to take the place of an assistant or a friend? How much better can bots become so that we can rely on them?

Whenever we talk about AI, we must keep in mind the mathematician Alan Turing and his contribution to the development of AI since 1935, when he completed his studies, and especially since 1950, when the "Turing test" he defined the conditions under which artificial intelligence can be compared to human intelligence.

In 1950, Turing published his paper entitled "Can machines think?". This paper contributed greatly to the development of computers and artificial intelligence. At the very young age of 43, with his personal life in ruins, Turing committed suicide, but the question remains. What could he have contributed to science and society if he had lived a few decades longer?

Modern applications of chatbots are evolving and expanding at a rapid pace and include:

- Customer service on websites and applications
- User support on platforms and social networks
- Education, entertainment, and psychological support
- Artificial intelligence conversationalists (such as ChatGPT)

The future challenges and expectations from the development of chatbots are enormous, such as:

- The need to understand context and emotions.
- Avoiding misinterpretation or misinformation
- Ethical and legal issues for use in sensitive areas
- Continuous improvement through AI and machine learning

1.4.3 How Chatbots Work

The operation of a chatbot is based on a series of techniques, including the following.

Input recognition:
The chatbot receives communication from the user (text or voice and processes it.
Natural language processing (NLP). Using NLP, the chatbot analyses the user's message, i.e. it recognises keywords, phrases, sentences, etc.

Processing and analysis
The chatbot compares the input data or a set of rules to determine the appropriate response.

Response generation
Based on the preceding analysis, the ChatBot generates a response, which may be simple text, an image, a video, or an action.

Machine learning (ML).
The most advanced Chatbots use machine learning to continuously improve themselves, learning from interactions with users and adjusting their responses accordingly.

1.4.4 What are the different types of Chatbots?

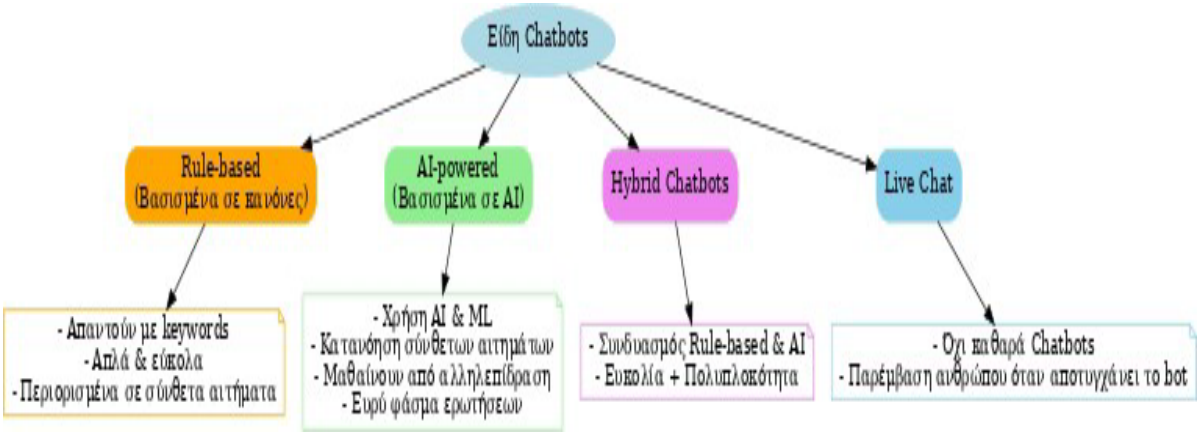
Chatbots are divided into different types depending on their complexity and capabilities.

Rule-based chatbots.
These follow a predefined set of rules and respond based on specific keywords or phrases. They are relatively simple and easy to implement, but their ability to handle complex requests is limited.

AI-powered chatbots.
These use artificial intelligence and machine learning to understand more complex requests and learn from interactions with users. They are able to handle a wider range of questions.

Hybrid Chatbots.
They combine features of both rule-based and AI-powered chatbots, offering a balance between ease of use and complexity.

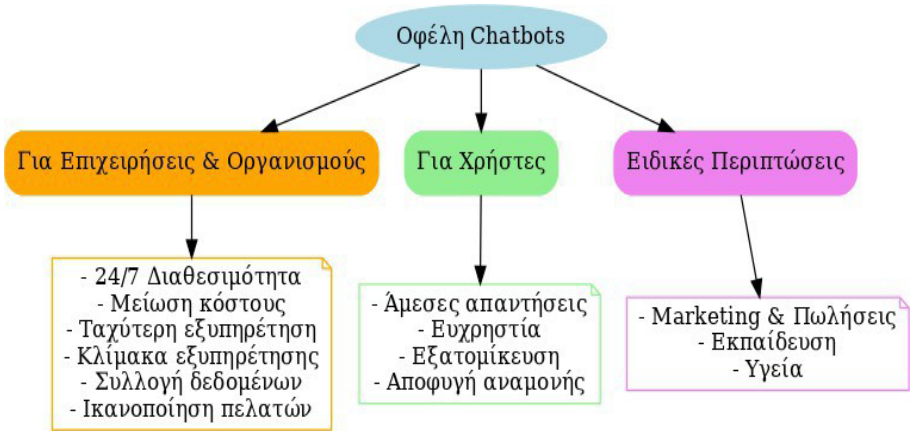
LiveChat.
These are not strictly chatbots, but a variation where a human intervenes when the chatbot cannot handle a request.



1.4.5 What are the benefits of Chatbots?

The benefits of using chatbots can be few or many and depend on how users utilise their capabilities. Some of the most common benefits are:

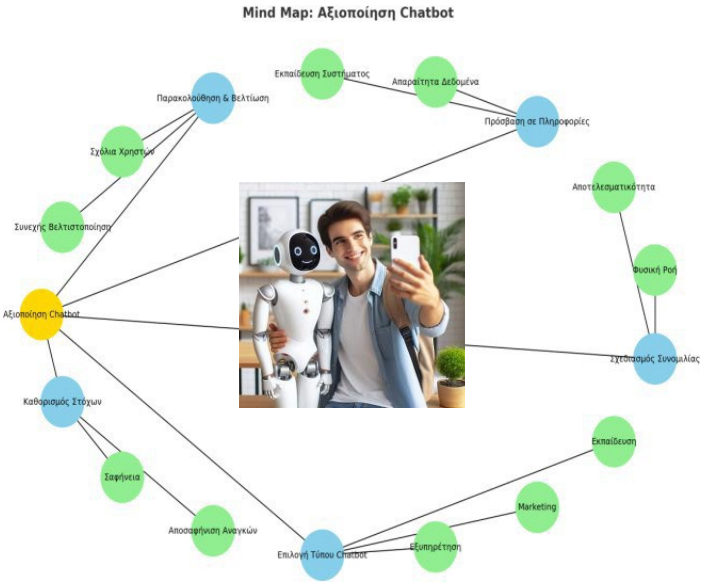
- Optimal service, by providing immediate support, answering questions and solving problems in real time.
- Reducing costs by automating processes, thereby reducing operating costs.
- Increased productivity, because they free employees from repetitive tasks and allow them to focus on more creative activities.
- Personalised experience, which applies to the most advanced chatbots, which can tailor their responses to the needs of each user.
- Increased sales, because they can help customers find the products they want and complete their purchases.
- Data collection, providing valuable information about customer needs and preferences and helping businesses improve their products and services.



1.4.6 How to leverage Chatbots

The degree to which chatbots are utilised depends once again on the user and how they utilise their capabilities.

To get the most out of Chatbots:



- Define clearly your goals and clarify what you want to achieve.
- Choose the type of chatbot that best suits your needs.
- Design and create a natural and effective conversation flow.
- Ensure that the Chatbot has access to all the necessary information and has learned how to use it.
- Monitor and improve the Chatbot's performance based on user feedback.

1.5 What is Generative AI (GEN AI)

1.5.1 A brief history of GEN AI

GEN AI can be considered an evolution of AI. In the 1980s, scientists were trying to move beyond the predetermined rules and algorithms of traditional AI. Thus, they laid the foundations for GEN AI by developing new generative models such as the Hopfield Network and Boltzmann machines (1980-1990), restricted Boltzmann machines (2006), the GEN AI genetic adversarial network, which had an impressive ability to produce realistic image data (2014), and improved natural language processing models (National Languages Processing) (NLP) (2020).

Today, GEN AI is a dynamic field with a variety of applications that go beyond the limits of what AI produces, while at the same time efforts are being made to make it controllable and ethically responsible.

The history of GEN AI is proof of the progress of artificial intelligence, as a combination of theoretical foundations and innovative practical applications with the aim of shaping a future where artificial intelligence will enhance human creativity in innovative ways.

1.5.2 How GEN AI works.

GEN AI is based on the principles of machine learning, a branch of artificial intelligence that allows machines to learn from **"Input Data,"** but goes one step further by creating new "Data Variants" that mimic the properties of the Input Data.
The cornerstone of GEN AI is "Deep Learning," a type of machine learning that mimics the functioning of the human brain in terms of data processing and the creation of patterns that lead to decision-making.
In all GEN AI models, the sequence followed is as follows:

- **Data collection.**
  A large data set is collected, containing examples of the type of content to be created. For example, in order to create images, similar images are collected, while for the creation of sentences/texts, a set of text data is collected.
- **Model training.**
  GEN AI is constructed using neural networks and trained to create new structures and data based on the data it has been fed.
- **Production.**
  Once the model is trained, it can create new content similar to the model it has been trained on.
- **Restriction.**
  Depending on the pre-processing that has been done and the application that follows, the content that will be created can be improved to meet specific requirements.

1.5.3 Types of GEN AI

GEN AI can appear in the following types of models.

- **Converter-based models.**
  For text generation, the models are based on converters such as GPT-3 and GPT-4, using an architecture that allows them to examine the entire input text and produce excellent and accurate new text.
- **Models based on generative adversarial networks (GANs)**.
  GANs consist of two parts, the generator and the discriminator. The generator creates new versions of data, while the discriminator evaluates the authenticity of the new versions. With continuous use of the model, the generator acquires the ability to produce excellent new data.
- **Variational Autoencoder (VAE) models**.
  VAE is a type of model that uses statistical principles. They work by encoding the "input data" and then decoding it in a new way to create new data. The "randomness" factor in this process allows VAE to provide different but similar new versions of the data.

1.5.4 Examples of GEN AI use

GEN AI, with its unique ability to create new data, leads to a variety of applications in areas such as the following:

Arts and entertainment.
GEN AI has been used, among other things, to:

- Create works of art in the style of famous painters.
- Create musical compositions with multiple instruments and different styles,
- Create film scripts, novels, poems and all kinds of literary expression.

Technology and communication.
GEN AI is used in the field of Technology and Communication to help:

- Graphic designers can create new designs in less time.
- Architects to design buildings or other structures based on specific construction and architectural needs.
- In the creation of advertising campaign models with desired aesthetic results.

Science and medicine.
GEN helps the biosciences and is used:

- For the production of new personalized medicines in much less time.
- In medical data imaging, where GANs are used to synthesise imaging data.
- In AI training.

1.5.5 Prerequisites for the application of GEN AI

The application of GEN AI requires the implementation of certain technical and ethical considerations in order for GEN AI to become generally accepted. To achieve the desired result, continuous dialogue and cooperation between technologists, lawyers, experts and social actors in order to achieve the responsible use of Artificial Intelligence, while reducing the risks associated with its use. Some of these rules are:

Data quality.
In order for GEN AI models to be implemented, a significant amount of high-quality data is required, which is very difficult to obtain in many cases. This may be the case when:

- The data is rare due to its nature.
- It constitutes "sensitive data" or "protected data", such as medical or financial data.
- The diversity and representativeness of products must be ensured.

This is a very complex process which, in order to be successful, requires experience in gathering and combining the necessary data, while ensuring confidentiality and privacy.

Complexity of training.
Training in GEN AI models, especially the more complex ones such as GANS, is intensive, time- consuming and also requires such a degree of experience that it can cause problems for smaller organisations or newcomers to the field of AI. In some cases, a pre-trained model can achieve the desired goal better, faster and at a lower cost.

Productivity control.
In some cases, the models produced may generate undesirable, irrelevant, incorrect, offensive or biased results. The application of mechanisms for filtering and controlling the content and the results produced can ensure its suitability.

Ethical concerns.
GEN AI often raises ethical concerns regarding the authenticity and reliability of the results produced. This is because it can contribute to misinformation and be used for fraudulent activities. For this reason, it is vital to develop "Strong Ethical Rules". In addition, improving users' knowledge of AI can minimise the risks of misinformation or fraud.

Regulatory gaps.

The lack of "Regulatory Guidelines" for the use of GEN AI, combined with the ever-growing use of AI, often leads to uncertainty and potential legal disputes.

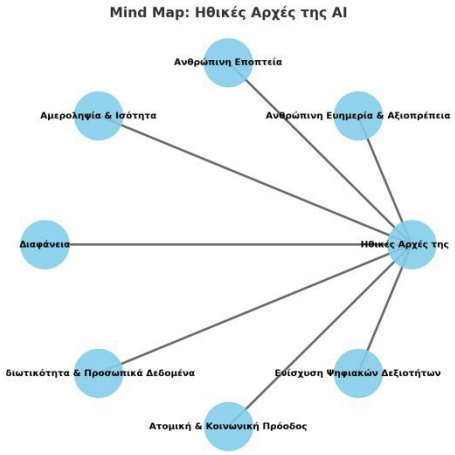
1.6 Problems arising from the use of AI and GEN AI

1.6.1 Ethical issues

The ethics of artificial intelligence is a set of rules that ensure that AI is developed and used in ways that are beneficial to society and includes, among other areas, justice, security, particularly of personal data, transparency in actions affecting society as a whole, prevention of actions that could have a social impact, etc.

AI ethics, with the above conditions, is a positive force that helps to limit injustices and strengthens creativity. The more natural or legal persons rely on AI, the more likely they are to experience the positive or negative effects of its use. While the technology on which AI is based can be designed to prioritise ethical issues, the human factor is what ensures that it operates according to ethical rules. To date, there is no **"Universally Agreed System of Ethical Principles for AI".** Many organisations however are working towards creating guidelines on **Ethical AI Law.**

1.6.1.1 Examples of Ethical Principles of AI



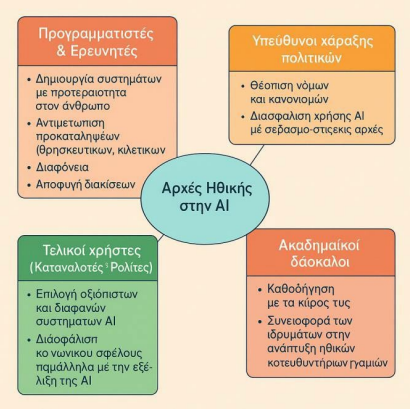
These principles mainly concern

- **Human well-being and dignity.** AI must prioritise and ensure the well-being, safety and dignity of individuals and not aim to replace them.
- **Human oversight.**
  To ensure that ultimate responsibility lies with humans, AI needs human oversight and monitoring at every stage of monitoring and use.
- **Impartiality and Equality.**
  AI design processes must prioritise fairness and be impartial and free from any form of discrimination based on gender, race, religion, etc.
- **Transparency.**
  AI models must propose solutions and recommendations through completely transparent processes and in a completely clear manner.
- **Support for privacy and personal data protection**. AI models must follow standards that ensure **"Avoidance of Personal Data Breaches"** and protect **"Privacy"** in all its forms.
- **Individual and social progress**.
  AI must contribute to **"Individual and Social Progress"** in all areas of social life, preventing practices of inequality and unfair competition.
- **Strengthening digital skills**.
  AI must be understandable to all, services must be accessible to all, and they must contribute to the upgrading of digital skills.

1.6.1.2 Applying "Ethical Principles" to AI

The application of "Ethical Principles in AI" is incumbent upon all of us who are involved, to a greater or lesser extent, directly or indirectly, in the design of AI models and the use of these models. The groups involved include natural persons and legal entities with different roles, such as:

- **Developers and Researchers.**
  They play a key role in the creation of AI systems, giving priority to humans, dealing positively with all forms of prejudice (religious, racial, etc.) and aiming for transparency and the avoidance of all forms of discrimination.
- **Policy makers.**
  They must enact laws and regulations that will promote the use of AI with respect for ethical AI principles.
- **Academic teachers.**
  With their authority as individuals and scientists, as well as the authority of the institutions they represent, they contribute to the development of ethical guidelines for the use of AI.
- **End users of AI**
  End consumers and citizens have an interest and a duty, through their behaviour towards AI products, to ensure that the AI systems they use are reliable, transparent and beneficial to society, while contributing to social development alongside the development of AI.



1.7 Data protection and AI

AI technologies create a wide range of opportunities in many social activities. AI systems involve, among other things, the processing of personal data. This raises the need to establish rules governing issues between AI and 'citizens' personal data', such as rights relating to:

- individuals' freedom of thought,
- freedom of expression,
- freedom of access to information,
- the right to conduct business by legal means,
- the right to education.

For the specialised training of individuals involved in personal data protection, the Personal Data Protection Authority has developed Special Study Programmes for data protection officers (DPOs) and privacy professionals, as well as for cybersecurity programme managers and AI system development programme managers.

A basic prerequisite for the protection of personal data is the methodology that must be followed, which concerns the "Security of Personal Data Processing" and includes:

- **Confidentiality.**
  Information/data must not be disclosed to unauthorised individuals.
- **Integrity.**
  The information/data must be accurate and authentic, not incorrect, Alteration or non-updating of information/data is not permitted.
- **Availability**.
  The information/data must be available to Users whenever requested.

The "Data Controller" is obliged to comply with the above terms. At the same time, they are obliged to manage incidents of non-compliance, which requires the existence of mechanisms and procedures for identification, recording, notification to the competent authority and communication to the persons affected.
It is certain that the competent authorities must become more involved in order to create regulations and policies that will be dynamic and will be renewed/adapted in line with advances in technology and its practical applications. These issues were presented at a meeting of the European Council Committee on the Future of Science and Technology, STOA. During the conference, experts referred to cases of "**Human Rights and Personal Data Violations**" by AI, highlighted the existing risks and referred to the need for "Safety Measures to Prevent Inappropriate/Illegal Use of AI."
The General Data Protection Regulation (GDPR), in force since 2018, aims to protect individuals from the leakage of their personal data, but also experts in personal data management from potential errors or omissions in the processing, distribution and storage of such data.

1.8 Regulatory and Legal Frameworks

1.8.1 Artificial Intelligence and Privacy

Since artificial intelligence has entered our lives, those of us who use it must do so while respecting the "privacy" of others. The voluntary or intentional failure to respect the "Rules of Privacy" and "personal data" constitutes an offence and is punishable under national, Community or international law.
We must all realise the need to respect the privacy of others, even if they are young. Thus, the role of the teacher becomes particularly sensitive, because they are given the opportunity, during the educational reality they experience every day in the classroom with their students, to demonstrate:

- How much respect they show for the individual characteristics of their students, colleagues or parents, through their actions and suggestions, the principles of honesty and discretion that should govern human relationships
- How carefully they use modern technology so as not to offend human dignity and to protect the privacy and personal data of our fellow human beings.
- That they carefully and responsibly examine the results provided by artificial intelligence in terms of their reliability before applying or sharing them.

Raising awareness among students from an early age on issues such as:

- the reliability of the information provided by artificial intelligence
- respect for human rights, including privacy,
- the proper and reasonable use of AI.

For the above reasons, we thought it would be useful to outline below the basic principles of the legal frameworks that govern and protect individuals' privacy and personal data. Teachers should endeavour to teach these principles to students in various ways, such as:

- describing simple cases related to personal and life experiences that they had
- applications of good practices (to be emulated)
- applications of bad practices (to be avoided)

The following texts have been selected from the presentation by Ms Magdalini Fasoulaki, Associate Member of the Council of State, on "Artificial Intelligence and Privacy: Conflicts and Balances" (the full presentation is available on the website https://www.esdi.gr/wp- content/uploads/2025/01/fasilaki_2024.pdf).

Privacy

Based on the above, we strive to develop and highlight the importance of privacy to our students. The Right to be let alone:

- This includes the right to a private life, exclusive control over access to private space (home asylum), minimisation of interference, the right to confidentiality, and protection of personal data.
- It aims to protect individual autonomy and develop human personality without external interference.

Examples of Artificial Intelligence Systems

The following examples enable educators to use AI in various situations, such as:

- Biometric identification systems
- Automated exam grading
- Automated CV evaluation software for employee recruitment
- Automated student welfare systems
- Grading systems
- Asylum application review software
- Predictive monitoring of student group characteristics

1.8.1.1. Legal texts

The texts that follow, describe the rights of citizens, including students:

Article 8 ECHR

- Everyone has the right to respect for his private and family life, his home and his correspondence.
- There shall be no interference by a public authority with the exercise of this right except such as is in accordance with the law and is necessary in a democratic society, is necessary for the national security, public safety, the economic well-being of the country, the prevention of disorder or crime, the protection of health or morals, or the protection of the rights and freedoms of others.

Charter of Fundamental Rights of the Union Article 7

Everyone has the right to respect for his or her private and family life, home and communications.

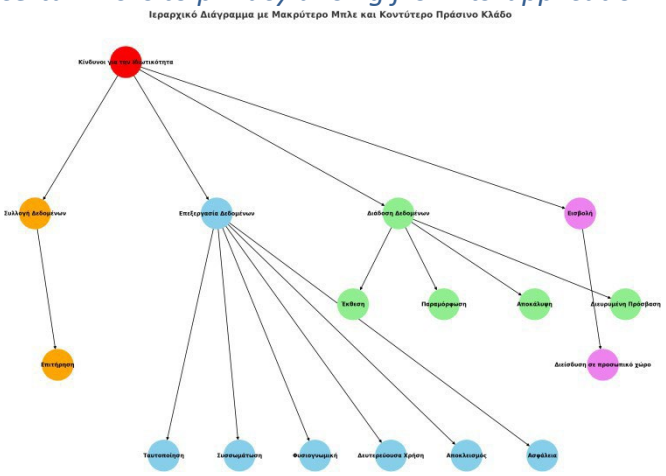
Article 8

1. Everyone has the right to the protection of personal data concerning him or her.

2. Such data must be processed lawfully, for specified purposes and on the basis of the consent of the person concerned or for other legitimate reasons provided for by law. Everyone has the right to have access to the data collected concerning him and to obtain their rectification.

3. Compliance with these rules is subject to the control of an independent authority.

1.8.1.2 Artificial intelligence and certain risks to privacy arising from its application.



The following must be taken into account by those who use AI:

When collecting data:

- Surveillance

When processing data:

- Identification
- Aggregation
- Physiognomic
- Secondary Use
- Exclusion
- Security

When disseminating data:

- Exposure
- Distortion
- Disclosure
- Extended access

Intrusion (in the narrow sense):

- Intrusion into personal space

Source: Deepfakes, Phrenology, Surveillance, and More! A Taxonomy of AIPrivacy Risks (Oxford University and Carnegie Mellon University)

1.8.1.3 The Right to Human Intervention (ARTICLE 22 GDPR)

The right to object under Article 22 of the General Data Protection Regulation may be exercised when:

1. The data subject has the right not to be subject to a decision based solely on automated processing, including profiling, which produces legal effects concerning him or her or similarly significantly affects him or her:
   - (para. 2) Exception: -contract, legal provision, explicit consent
   - (para. 3) In principle, exclusion of the exception for sensitive data such as
   - right to information and access
   - right to rectification
   - right to erasure
   - right to restriction of processing
   - right to object

<u>Control obligations</u>

Can be done by:

- By the European Data Protection Board and the European Data Protection Supervisor: Guidance on the use of AI to ensure fundamental rights
- National data protection authorities: Practices and guidelines on how data protection provisions apply to the use of AI.
- Access to justice

Limitations, balancing and proportionality

The use of AI systems is linked to a wide range of fundamental rights, such as the following

- Privacy
- Data protection,
- Prohibition of discrimination
- Access to justice
- Human dignity
- Right to social security and social assistance,
- Right to good administration (which mainly concerns the public sector)
- Consumer protection

A key concept running through EU law and case law is that of proportionality. The restriction of a protected right is permissible to the extent that it is necessary and appropriate for achieving a legitimate objective. The requirements of necessity and appropriateness are complemented by the prohibition of excessive or disproportionate restrictions on the right to privacy.

Golden rule:

Ad hoc balancing of proportionality between the protection of privacy and objectives of general interest or fundamental rights of third parties, taking into account the circumstances of each case

Relevant court decisions

Below are some indicative court decisions relating to the protection of privacy.

a. Decision of 16/2/2023 of the German Federal Court

Automated data processing for the purpose of analysis or interpretation:

- constitutes an interference with the individual's right to informational self-determination.
- constitutes a distinct interference, as it may have specific and harmful consequences, more intense than those of the initial collection.
- requires further justification based on the principle of proportionality.
- it is constitutionally justified only for the protection of a particularly important legal interest against which there is at least a proven risk

b. Decision of the Conseil Constitutionnel of 17 May 2023

The aim is to protect a constitutionally protected interest, namely public order and security. Algorithmic processing is only carried out in the context of major sporting, cultural or recreational events, where large numbers of people are present and, due to their size and importance, they may be the target of terrorist or other serious attacks against public safety.

An administrative decision is required, which must be justified and specify the controller, the geographical perimeter where video surveillance will take place and its duration.

Algorithmic processing is intended solely for the detection and warning of suspicious activity. Judicial review is provided for.
Human intervention is provided for, to check the results.

c. Decision of the Council of State 1206/2024 (Section D)

The obligation of the administration to justify its individual decisions is a constituent element of the rule of law, consistent with the principles of transparency and legality of administrative action, but also of effective judicial protection.

In the event of a challenge to the legality of an individual administrative act issued wholly or partly on the basis of automated data processing, the decision issued on the relevant appeal must indicate both the critical stages of the mathematical calculations performed by the Authority and the actual data (variables) taken into account in that regard, so that, on the one hand, the person concerned is in a position to ascertain whether the conditions for its examination laid down by the relevant rules of law have been complied with in his case and, on the other hand, the judge is able to exercise effective judicial review.

With the above indicative decisions, as well as many others issued by the judicial authorities of many states or international organisations, it is clear how careful the use of Artificial Intelligence must be so as not to involve/affect the privacy of legal or natural persons. Teachers must play an important role in their educational work, emphasising in many ways and with specific examples to their students the value of respecting the 'privacy' of all young and old alike, and that this is an 'element of social culture'.

1.8.2 Artificial intelligence and personal data

The following texts are excerpts from the thesis of a postgraduate student at the Law School of Aristotle University of Thessaloniki, Mr. Zoë Panagopoulos (Members of the evaluation committee are professors I. Inglezakis, A. Tsousis and A. Takis. The texts raise important issues for all those involved in IT, and particularly in our case, teachers, so that they can orient their teaching in every way towards sensitive issues such as "Personal Data" of all individuals. Full details on the website (https://ikee.lib.auth.gr/record/330313/files/GRI-2021-30390.pdf)

ARTIFICIAL INTELLIGENCE IN RELATION TO THE GENERAL DATA PROTECTION REGULATION

LEGISLATION ON ARTIFICIAL INTELLIGENCE

Artificial intelligence refers to a wide range of applications, uses and methods. Its rapid development and the way in which it has managed to penetrate the fields of economics, health, labour relations, private life and ethics makes it necessary to strengthen the existing legislative framework covering it, so that its future development can overcome any concerns arising from its widespread use and application.

Therefore, the issue of privacy and its protection in the application and widespread use of Artificial Intelligence is a complex one. According to the Universal Declaration of Human Rights, and specifically Article 12 thereof, "no one shall be subjected to arbitrary interference with his privacy, family, home or correspondence.
Everyone has the right to the protection of the law against such interference or attacks." International law requires that any interference with the right to privacy must be lawful, necessary and proportionate.
In the event that a State uses artificial intelligence in such a way that it infringes the right to privacy, its use must be subject to the aforementioned checks of legality, necessity and proportionality. With regard to profiling, which may involve the use of artificial intelligence methods to extract or predict information about natural persons for the purpose of assessing them, the United Nations Human Rights Council states that
The "automated" processing of personal data for the creation of individual profiles may lead to discrimination or decisions which may affect the exercise of human rights, including economic, social and cultural rights.
International human rights authorities have taken action to recognise the important right to anonymity, in accordance with freedom of expression and the right to privacy. As can be logically inferred, the above has implications for the application of Artificial Intelligence for the electronic tracking of natural persons, or for the tracking of them at home them or in public spaces. Indeed, the UN Special Rapporteur on Freedom of Expression has repeatedly recognised this connection and has strongly emphasised, in accordance with Article 19 of the Organisation, that state intervention with regard to anonymity should be subject to scrutiny in terms of its legality, necessity and proportionality. With the protection of personal data, the regulatory framework applies to the research, development and implementation of AI, to the extent that personal data is included. Regulatory frameworks vary between countries, but overall they are designed to provide adequate protection for the personal data of data subjects and in such a way as to create the belief that this protection is an important manifestation of the right to privacy.

Opinion of the European Economic and Social Committee on 'Artificial intelligence — The impact of artificial intelligence on the (digital) single market, production, consumption, employment and society', No 2017/C 288/01 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52016IE5369&rom=EN , available online at 04.05.2020.

1.8.2.2. The Legislative Framework for Artificial Intelligence from the European Parliament

The European Commission for Justice, of the Council of Europe, on 4 December 2018, consisting of the forty-seven member countries of the Council of Europe, adopted the European Charter of Ethics.

This is a text that sets out the fundamental ethical principles of artificial intelligence models, respect for human rights in the design and implementation of artificial intelligence techniques, the prohibition of discrimination, quality and safety in the processing of judicial decisions and data, transparency, integrity and, finally, the assurance of human intervention, "under user control".

The Expert Committee also published a number of legal texts, recommendations and studies on the implications of automated data processing and Artificial Intelligence for human rights, the most important of which are the "Study on the impact of advanced digital technologies", including Artificial Intelligence systems, in the context of human rights, the Recommendation of the Committee of Ministers to Member Stateson the impact of algorithmic systems on the protection of human rights, and the Declaration of the Committee of Ministers on the consequences of manipulation that algorithmic processes may have.

Consequently, it is also worth mentioning the amending Protocol to Council of Europe Convention 108 on the protection of individuals with regard to automatic processing of personal data, which was the first legally binding international instrument adopted in the field of data protection. Its purpose was to ensure that every natural person "enjoys respect for his or her rights and fundamental freedoms, and in particular the right to privacy, with regard to the automated processing of personal data."

Today, it has been ratified not only by all member countries of the Council of Europe, but also by Argentina, Burkina Faso, the Republic of Cape Verde, the Republic of Mauritius, Mexico, Senegal, Morocco, Tunisia and Uruguay. The protocol amending this Convention aims to broaden its scope, increase the level of data protection and improve its effectiveness. Among the innovations it introduced was the establishment of new rights for individuals in an algorithmic decision-making context, which are particularly important in relation to the development of artificial intelligence.

1.9 Legislation on AI

AI refers to a wide range of applications, uses and methods. Its rapid development and the way in which it has managed to penetrate the fields of economics, health, labour relations, private life and ethics it is necessary to strengthen the existing legislative framework covering it, so that its future development can overcome any concerns arising from its widespread use and application. Therefore, the issue of privacy and its protection in the application and widespread use of Artificial Intelligence. According to the Universal Declaration of Human Rights, and specifically Article 12 thereof, states that "no one shall be subjected to arbitrary interference with his privacy, family, home or correspondence. Everyone has the right to the protection of the law against such interference or attacks."

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With the protection of personal data, the regulatory framework applies to the research, development and implementation of artificial intelligence, to the extent that personal data are included. Regulatory frameworks vary between countries, but overall they are designed to provide adequate protection for the personal data of individuals in such a way as to create the belief that this protection is an important manifestation of the right to privacy.

Opinion of the European Economic and Social Committee on 'Artificial intelligence — The impact of artificial intelligence on the (digital) single market, production, consumption, employment and society',
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THE LEGISLATIVE FRAMEWORK FOR ARTIFICIAL INTELLIGENCE BY THE EUROPEAN PARLIAMENT

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The Expert Committee also published a number of legal texts, recommendations and studies on the impact of automated data processing and artificial intelligence on human rights, the most important of which are the Study on the impact of advanced digital technologies, including artificial intelligence systems, on human rights, the Recommendation of the Committee of Ministers to Member States on the impact of algorithmic systems on the protection of human rights, and the Declaration of the Committee of Ministers on the manipulative effects of algorithmic processes.

Consequently, it is also worth mentioning the amending Protocol to Council of Europe Convention 108 on the protection of individuals with regard to automatic processing of personal data, which was the first legally binding international instrument adopted in the field of data protection. Its purpose was to ensure that every natural person "enjoys respect for his or her rights and fundamental freedoms, and in particular the right to privacy, with regard to the automated processing of personal data". Today, it has been ratified not only by all member states of the Council of Europe, but also by Argentina, Burkina Faso, the Republic of Cape Verde, the Republic of Mauritius, Mexico, Senegal, Morocco, Tunisia and Uruguay. The protocol amending this Convention aims to broaden its scope, increase the level of data protection and improve its effectiveness. Among the innovations it introduced was the establishment of new rights for individuals in an algorithmic decision-making context, which are particularly important in relation to the development of artificial intelligence.

In October 2020, the European Parliament approved proposals aimed at an improved legislative framework for the use of artificial intelligence, with the aim of strengthening ethical standards, innovation and, in particular, the trust of citizens and users in the technology. Indeed, the European Parliament is one of the first institutions with an institutional position to make recommendations on rules relating to artificial intelligence and their content in matters of ethics, civil liability and intellectual property issues. These recommendations aim to prepare the ground for the European Union to take the lead in the development and research of artificial intelligence.

KEY QUESTIONS FOR CHAPTER 1

After completing Chapter 1, participants should be able to answer key questions, such as those below, to check whether they have acquired the knowledge covered in the chapter.

- Describe in your own words: what is "Artificial Intelligence (AI)" and how does it differ from "Generative AI (GEn AI)"? Give 2 specific differences.
- What are Large Language Models (LLMs) and why might they produce incorrect or misleading information?
- List three indicative tasks/uses that LLMs can perform (e.g. at school or at work).
- Why is the quality (not just the quantity) of training data critical to the performance of an LLM? Give an example.
- A brief history of chatbots: Put ELIZA, PARRY, A.L.I.C.E., digital assistants (Siri/Assistant/Alexa) and GPT-based bots in chronological order, with a very brief description of each.
- What are the main points of differentiation between ELIZA and a modern chatbot such as ChatGPT?

- What are two benefits that chatbots offer to organisations/websites, and what is a potential disadvantage when interacting with humans?
- Select three ethical principles for AI (e.g. human oversight, impartiality/equality, transparency, privacy) and explain how you would apply them in a real-world scenario.
- What are the two main ethical or social issues arising from the use of AI/LLMs and what practical measures would you suggest to mitigate them?
- On 2 March 2023, an open letter was published calling for a halt to the development of systems more powerful than GPT-4. Do you agree or disagree? Justify your position.

CHAPTER 1 CONCLUSION

As demonstrated by the above, on the one hand, Artificial Intelligence, which has been booming in recent years, is set to bring significant developments in the future for society and the economy of the modern world, as it is now widely used for a multitude of human activities. On the other hand, data protection has a remarkable global dimension, as people around the world increasingly consider the protection and security of their data to be important and attach particular importance to it. Many countries have adopted or are in the process of adopting comprehensive data protection rules based on principles similar to those of the General Data Protection Regulation, resulting in the global convergence of data protection rules. This offers new opportunities to facilitate the flow of data between commercial entities or public authorities while improving the level of protection of personal data in the European Union and around the world.

A critical issue is whether the widespread use of artificial intelligence systems is in line with the provisions of legislation in general and the provisions of the General Data Protection Regulation in particular, and whether it can ensure the protection of the data subject's personal data and establish a sense of trust in the application.

In this context, the potential risks of the widespread use of artificial intelligence in electronic transactions were also studied, as well as the extent to which the security of privacy and personal information can be achieved when completing digital payments. The increasingly widespread use of artificial intelligence systems carries the risk of a lack of transparency, in the sense that it is not immediately apparent to the average person how they work and, in particular, how decisions are made on their behalf. More specifically, and particularly in view of the confusion surrounding the issue of consent, which in most cases the data subject is not in a position to understand, both in terms of what they are consenting to and the exact reasons for consenting, the risk of problems arising is increased. The risks generally concern issues of ensuring the protection of people's personal data, which is collected extensively through the use of AI and is further processed in order to achieve the respective purpose of the algorithm. On the other hand, we should always keep in mind the expanded possibilities that provides the artificial intelligence, mainly in optimising everyday life and the quality of life it offers to society, as it contributes to the immediate execution of actions. A telling example of the value of artificial intelligence is its recent use in the development of the Covid-19 vaccine, which has brought safety and life to millions of citizens worldwide. The vaccine was discovered in a very short period of time by utilising artificial intelligence models, while it is clear that without it, the scientific community would have needed several more years. However, one thing remains crucial: only when a balance is achieved between artificial intelligence and the protection of individual privacy will artificial intelligence be considered the perfect human discovery.

Chapter 2

2.1 CHAPTER 2OBJECTIVES

Upon completion of Chapter 2, the learner will be able to understand the following objectives:

- **General objectives of AI:**
  - Define what Artificial Intelligence is and how it is used in education, and explain its basic uses, benefits and risks.
  - Distinguish the role of teachers and students in the use of AI and describe principles of balanced, transparent and ethical use.
  - Evaluate the reliability of AI information/tools and determine whether they comply with ethical and data protection rules.
  - Designs a framework for integrating AI into schools, taking into account resources, infrastructure and potential inequalities.
  - Draws up basic rules for responsible use (human-AI balance, transparency, trust, ethics).
  - Identifies organisational/economic requirements and proposes measures to reduce inequalities.
- **Use of AI by Educators**
  - Compares group versus individualised learning using AI and describes the implications for teaching.
  - Maps teacher skills in the age of AI (technological competence, pedagogical design).
  - Designs personalized learning with AI and evaluates results.
  - Recognises risks (overdependence, lack of transparency) and adopts risk reduction strategies.
  - It compares functions/limitations basic tools (ChatGPT, Perplexity, Claude, Napkin, Microsoft Designer, Gemini).
  - Selects the appropriate tool for each teaching objective (text production, source search, visualisation, creative design).
  - Designs micro-classroom activities that utilise the tools with pedagogical and ethical competence.
- **Use of AI by Students**
  - Describes benefits/risks for their students (misinformation, privacy, social isolation).
  - Implements digital Digital Education activities: sources, verification, responsible use of data.
  - Detects signs of inappropriate use of AI in assignments and intervenes pedagogically.

2.2 Introduction of AI in Education

2.2.1 AI in Education

In a rapidly changing world, where yesterday's technology is outdated compared to today's, it is expected that AI will play an important role in shaping educational processes and the way teachers teach at every level, as well as the way students learn.

Despite the undoubted benefits of using AI in education, there are also points that highlight the need to follow certain basic rules and responsible practices in order to make proper use of the positives and reduce the weaknesses in the use of AI in education.

Examples of rules and practices that should be followed are:

- Maintaining a balanced use of AI in relation to the initiatives that must be taken by the human factor (teachers, students).
- Maintaining the trust of students and parents in teachers.
- Maintaining objectivity and transparency on the part of teachers towards their students when making decisions or suggestions related to the present (their progress in class) or their future (studies or employment).
- Maintaining ethical rules that should govern the introduction of AI in education.

In conclusion, AI can offer a lot to the content of education and the way various subjects are taught, as existing platforms offer ideas and knowledge to teachers and students.

However, the process of integrating AI into the educational process of an educational institution requires significant resources and technological infrastructure, which may create inequalities between schools and students.

At the same time, the use of AI reduces the need for human administrative support and improves resource management, making their allocation more rational and efficient. The integration of AI into a wide range of human activities has been widely accepted by society. However, its integration into education raises many concerns and questions given the complexity of educational processes.

The educational policy of the 21st century must not turn its back on new technologies and AI, but must adapt appropriately so that today's students the adults of the future, can benefit as much as possible from current and future technological developments.

Educational research suggests that today's data should emphasise the acquisition of such skills by students so that they can be competitive in the society and work environment they will find themselves in tomorrow as adults.

The efforts of modern schools should be **to "teach students how to acquire knowledge rather than focusing solely on the acquisition of knowledge."**

2.2.2 The use of AI by teachers

The role of teachers in modern schools must be significantly upgraded. General and specific knowledge is not enough.

- general and specific knowledge
- human and educational sensitivities
- love for students
- understanding towards parents
- awareness of serious role that have as "role models for their students".

Among other things,

- continuous updating on issues related to the use of advanced technology in the service of education.
- in-depth knowledge of the tools provided by
- technological developments so that the performance of teachers can be boosted. For example, the correct use of "Interactive whiteboard" and the use of Artificial Intelligence AI are two simple examples of methods that lead to the upgrading of educational work.

In this chapter, we will look at the possibilities that AI offers educators.

Until now, teachers have addressed all their students in roughly the same way during the educational processes they follow. (Group learning).
From now on, they will be able to take advantage of the possibilities offered by AI and adapt their teaching to the learning characteristics of each student. (Personalised learning).
The use of appropriate AI applications enables teachers to address the weaknesses, skills and specific cognitive abilities of each student individually, so that the teacher can help each student approach knowledge in their own specific way and thus achieve the best possible results. In other words, AI can help to completely overhaul the way teachers teach and students learn.
Much has been written about the new educational reality, and many conferences and seminars have been held on the subject. One of these is the conference on
"Artificial intelligence in education" which was co-organised by the Department of Applied Informatics of the University of Macedonia and the Directorate of Secondary Education of Eastern Thessaloniki. We recommend that you study the proceedings carefully.
https://srv-dide-a.thess.sch.gr/portal2/attachments2/13283/AI%20&%20%CE%95%CE%9A%CE%A0% CE%91%CE%99%CE%94%20final.pdf
The application of AI in teaching can facilitate the work of educators, but the unlimited use of technology also entails risks, mainly related to the independence of human activity and critical thinking.
AI operates with "opaque operating rules" because artificial intelligence algorithms are involved in decision-making, because they draw information from various sources whose reliability is unknown, etc. factors that are directly linked to the degree of trust that students, parents and teachers may have in AI. It is also a fact that the excessive dependence of some teachers on the tools provided by, may reduce their personal judgement to a greater or lesser extent, as well as the creative teaching methods that they should and can develop.
As for students, education systems that rely too heavily on AI may contribute to limiting students' critical thinking skills and creative thinking.
The use of AI in educational processes must be done in moderation. If the assessment of a test or educational activity is based on AI, teachers should be able to justify the results of the assessment if asked. Otherwise, their credibility may be questioned, with all the consequences that this may have for their prestige as teachers and assessors.
Certainly, the assistance that AI provides to teachers in creating personalised teaching to meet the needs of specific students is significant and contributes to improving their professional image. However, excessive use of AI can turn some teachers into mere users of the tools and methods provided by AI, thereby reducing the development of their flexibility, creativity and adaptability to the multiple demands of their teaching role.
It is a fact that some AI applications give teachers more free time, which they can use for their personal and professional development.

2.2.3 The use of AI by students

Children and teenagers are growing up in a world where modern technology has invaded and the use of AI has become part of their everyday lives. Theoretically, there are many possibilities for students, even those in primary school, to use AI for their school needs. The question that arises is this: "Are they ready to take advantage of the positives that AI offers them and minimise the negatives, thereby limiting the risks of reckless use of technological applications?". Some of the potential risks for students are as follows:
Easy access to AI products tempts students to submit assignments that they have not worked on sufficiently themselves, meaning that they have not gained adequate knowledge.

- Often, AI products that reach students are based on incorrect data or misinformation and are used by students without prior consideration, as they should be.
- The use of technology by students and the provision of their personal data may lead to malicious use by third parties, and even to bullying.
- Processes for approaching "digital friends" that are designed for adults, when used by students, often pose risks to them.
- Students need to realise that different AI models are protected as "intellectual property" and are governed by specific rules, the most important of which is the protection of everyone's personal data.

The above highlights the need for students to acquire **"digital literacy".** This is the only way to exploit the positives of using AI and minimise the negatives.

In order for students to acquire digital literacy, teachers must:

- Explain how AI works, its capabilities and its weaknesses. Explain that there is a risk of spreading fake news and misinformation and that technological applications have no conscience or emotions.
- Encourage them to check and evaluate the information they receive as much as possible before accepting it. This process is not easy for students, especially young ones, but they must get used to it from an early age.
- They point out that excessive use of technology and AI applications may lead to social isolation and loneliness.

When students use references in their assignments that do not match the general picture they present in their daily classroom presence, this may be a cause for concern for teachers regarding the proper use of AI by students. These indications may relate to:

- The use of expressions and vocabulary that are unusual for the student
- Assignments that are much better written and more organised than the rest of the assignments presented by the student in class
- The student's inability to explain orally or provide more information about the assignment they presented.

2.3 Popular Artificial Intelligence tools.

Modern technology constantly surprises us, continuously providing new Artificial Intelligence Tools at such a pace and with such new capabilities that the information that follows may soon be considered outdated. Another feature of advanced new technologies is that they are easier to access and more user-friendly, allowing users to take full advantage of their capabilities.

Generative AI (GenAI) has begun to play an important role in education, influencing both teaching and learning. Teachers at all levels, from nursery school to higher education, are using GenAI technologies to improve teaching efficiency, create personalised educational material and enhance student participation.
Below you will find a list of the most popular artificial intelligence websites, along with information about the specific features of each one and how you could use them.

Indicative list of AI websites

- Chat GPT - https://chatgpt.com/
- Perplexity - https://perplexity.AI/
- Claude - https://claude.AI/login;returnTo=%2f3F
- Napkin - https://napkin.AI/
- Microsoft Designer - https://designer.microsoftcom/
- Google Geminihttps://gemini.google.com/

a)Use of AI by Educators as a Digital Education Tool for Students.

Although this technology has significant potential, careful planning and understanding of its limitations are required. It is essential to ensure that it is used in a pedagogically and ethically responsible manner, keeping the teacher at the centre of the learning process, while teachers must teach their students how to acquire digital literacy.

Digital literacy.

The acquisition of Digital Literacy by students is a complex process that requires them to understand how IT works, its capabilities and limitations.

- They must participate in systematic discussions about misinformation and the risk of spreading fake news.
- They must realise that artificial intelligence mimics human thought without having emotions. In this way, students will become aware of the real possibilities that AI offers them.

Critical thinking.

Acquiring critical thinking skills requires

- Learning to check the reliability of information sources as much as possible and being able to identify potential errors, inaccuracies, and false information provided by AI.
- Taking into account the ethical restrictions that are automatically imposed and relate to the privacy and personal data of others.

Emotional Intelligence.

To acquire Emotional Intelligence, students must

- Learn to develop relationships of trust with their classmates based on sound foundations.
- Learn to empathise with classmates who feel isolated from the rest or who are subjected to systematic, continuous or temporary harassment.
- Learn to cultivate feelings of respect and responsibility by participating in role-playing games and experiential activities.

Opportunity for students to utilise AI. Students will utilise AI:

- By incorporating AI into the process of creating projects in school subjects such as History, Geography, Mathematics, Physics, Literature, and others.
- By comparing texts generated by AI with texts written by students or teachers, thus identifying the advantages and disadvantages of AI. Teachers can use AI to create attractive educational material for various subjects, to create material for consolidating and assessing students' knowledge, and to create material for monitoring each student's school performance and extracurricular activities.

b)Use of AI by teachers as a teaching and management tool of general interest.

Teachers can use AI to create engaging educational material for various subjects, create material to reinforce and assess students' knowledge, and create material to monitor each student's academic performance and extracurricular activities.

Teachers can also use AI to design personalised study programmes for students with high or low IQs. Teachers must accept that AI is "here to stay" and must equip their students to coexist with it safely and responsibly.

2.3.1 Getting to know ChatGPT.

ChatGPT is an advanced artificial intelligence language model developed by OpenAI. It is designed to understand and generate human language in a natural and realistic way.

It can answer questions, help write texts, explain concepts, generate creative content such as stories or poems, and much more.

Using ChatGPT can improve productivity, enhance learning, and offer assistance in different areas such as education, work, and everyday life.

It is a tool with enormous potential that can act as an assistant, educational advisor or even a partner for creative ideas.

It is a tool that understands questions and can provide accurate and comprehensive answers in a very human style. This creates the feeling that you are not talking to a machine that can mimic human communication, but to another person.

Chat-GPT's training is based on data known as datasets found somewhere on the internet and involves the use of Machine Learning, Reinforcement Learning, and Natural Language Processing (NLP).

Chat-GPT's operation is based on feeding it a large amount of data, which it processes and uses the appropriate words to express the meaning and answer to each specific question asked.

Chat-GPT can also write texts, correct existing ones, identify errors in texts given to it, and even explain and teach.

Chat-GPT provides its services free of charge, but from 2023 the company that manages it will offer a paid version with upgraded services.

How to chat with ChatGPT.

To chat with ChatGPT, simply follow these steps.
1. Open the ChatGPT registration link in your browser.
2. Click on the "Sign Up" option.
3. Select your registration method.
    - Via email and password,
    - via Google account,
    - via Microsoft account.
4. Enter your email address.
5. Set a password for the chat.
6. Confirm and activate the password in your email inbox.
7. Provide the system with your phone number and country code.
8.Enter the code sent to your phone.
9. Once you have confirmed the code you entered, you can continue and use the services. Those interested in gaining more and more specialised knowledge about ChatGPT can visit:

- University of Crete https://robolab.edc.uoc.gr
- How does https://escritor.com/el/how-does%20chatgpt-work/ work?
- What risks does ChatGPT posehttps://citycampus.gr/chat-gpt/

The top Artificial Intelligence Writing tools for 2025 are:

- Eskritor: A multifunctional AI writing tool with powerful text editing and formatting features
- Jasper: Ideal for those who produce large volumes of material
- Copy.AI: Excellent for short texts and social media posts
- Writesonic: Flexible platform with powerful capabilities
- Rytr: Affordable, beginner-friendly tool for creating multilingual content
- Phrase: A tool focused on research and content creation with high-quality results

2.3.2 Getting to know Perplexity

Perplexity is a search engine enriched with the capabilities of a previous chatbot. It is an **"Answer Engine".**

It provides accurate, concise, and documented answers to user questions by drawing information from the internet.

The answers are presented in an understandable way, while citing the sources from which the information was drawn, which sets Perplexity apart from many other information models, thus providing additional credibility and allowing users to verify the information they receive. It uses language models (LLMs) with improved architecture for searching and synthesising information. Perplexity AI operates on the following basis:

- Understanding the query after the AI first analyses and understands "what exactly the user is asking for.
- Dynamic web search using various sources.
- Synthesis of information drawn from various sources.
- Formulation of a response that is concise and provides all the information gathered.
- Providing sources (links, articles, research) related to the question, allowing the user to delve deeper into areas of interest and confirm the validity of the information received.
- Copilot function, which offers a guided search experience.
- "Conversational Interface" for follow-ups, questions and clarifications.
- Available via web browser and mobile applications (iOS or Android).

More information can be found here.

- "What is Perplexity AI" https://www.grow-digital.gr/
- "A legitimate review of Perplexity AI" Unleash its potential https://www.arkthinker.com/el/AI/perplexity-AI-review/
- "Review of AI with perplexity" https://www.google.com/search;q=%2Fblog%2Fel-GR%2Fel- perplexity-AI-review&rlz=1C1FKPE_enGR1134GR1135&oq=%2Fblog%2Fel-GR%2Fel-perplexity-AI-review&gs_lcrp=EgZjaHJvbWUyBggAEEUYOTIKCAEQABiABBiiBDIKCAIQABiABBiiBDIKCAM QABiABBiiBDIKCAQQABiABBiiBDIGCAUQRRg6MgYIBhBFGDzSAQg3MDIxajBqNKgCALACA A&sourceid=chrome&ie=UTF-8
- "What is perplexity AI and how does it compare to ChatGPT and Gemini AI?" https://electronicanto.net/

2.3.3 Getting to know Claude

Claude is a modern AI system developed by Anthropic. Its first version was released in 2023. Claude is designed to be different from other AI systems, with a particular focus on three areas "useful, honest and unbeatable" and performs the tasks that an AI assistant can do, such as searching, creative writing, questions, answers and coding. Claude is used in various applications, such as education and training processes, and provides reliable answers based on the principles of ethics and personal data protection, as set out in the Universal Declaration of Human Rights. In addition to the standard version, Anthropic has also introduced Claude Instant, which is lighter and faster. Claude has demonstrated exceptional abilities in specific applications, including solving mathematical problems, and is a useful tool for educators. To serve its global user base, Claude supports multiple languages and different cognitive backgrounds.

Despite its advanced capabilities, Claude avoids misleading presentations of facts and limits itself to verified, accurate information.

Claude does not present subjective experiences or emotionally charged opinions that could lead to misunderstandings. Claude's architecture is equipped with 20 billion parameters, enabling it to generate highly human-like text, understand complex questions, and actively participate in discussions on various topics.

Claude's pricing is based on a flexible model that responds to the different needs of users. For casual users, Anthropic provides free access to the original Claude model via Claude.AI. For users seeking upgraded services, Anthropic offers the Claude Pro subscription at prices comparable to those of ClaudePro.

More information can be found at.

- Claude AI. How the AI landscape stands out https://plisio.net>blog>claude.AI
- Claude by Anthropic https://talkAI.info>blog>a.closer
- Can Claude create images? https://www.claila.com>blog

2.3.4 Getting to know Napkin

Napkin is a digital thinking and idea-capturing tool that helps users organise their thoughts in a creative and visually appealing way. It is designed to promote connections between different ideas through a dynamic and interactive canvas. Napkin encourages free thinking by providing an environment where users can quickly jot down notes, connect ideas, and create a personal knowledge map. Ideal for writers, creators, content creators, and anyone looking for a new way to manage their thoughts.

Napkin AI functions as a "Document Editing Platform" that specialises in converting text into visual images.

The platform uses AI tools to convert written text into graphic representations, diagrams, and videos.

Napkin AI follows security rules and measures that protect personal data.

Napkin AI may collect and use user information to enrich its information bank and improve its models.

Anyone interested in the activities provided by NAPKIN AI can create an account at https://app.napkin.AI.

Once the Napkin account has been created, users can follow the instructions and learn how to create images using Napkin AI.

The basic services and limited use of Napkin AI are provided free of charge.

For more usage and more services, the charge is comparable to other companies.

For more information, visit.

- "Getting started with Napkin AI" Help.napkin.AI/en/articles/9991710-getting-started-with-napkin-AI
- "Napkin AI – the visual AI for business storytelling" https://www.napkin.AI
- "Napkin AI: Create Engaging Visuals from Text in Seconds" Medium.com/data-science-perspective/napkin-AI-create-engaging-visuals-text-in-seconds-a84e017dad87

2.2.5 Getting to know Microsoft Designer

Microsoft Designer is an AI-powered graphic design and image editing application. It processes text and converts it into images, creates designs, edits photos, and helps visualise ideas. The application was introduced at the end of 2022 and became available to users in 2023.

To take advantage of Microsoft Designer's capabilities, users must follow these steps:

- Go to the Microsoft Designer home page.
- Click on "Create" and write what you want to do.
  Add your own image or select a pre-designed image for faster results.
- Make the desired changes to the image that appears.

Using the above process, you can create simple images or posters or achieve more complex results, as long as you give the application many precise instructions.

Microsoft Designer does not offer anything special in the "Creative Market", but it can add convenience for Microsoft Edge users.

In summary, Microsoft Designer

- It is a smart solution through AI because it understands the user's needs and suggests designs, colours, and fonts.
- It provides smart templates for every user need.
- Works with Word, PowerPoint, and OneDrive.
- It is user-friendly, even for beginners.
- It can create final results from a simple description of your idea.

Its advantages include:

- User-friendliness.
- The speed of creating results.
- Powerful artificial intelligence.
- No special installation required (just a browser).
- Works with other Microsoft tools.

On the downside,

- Limited specialised graphics capabilities.
- Requires an internet connection.
- It is inferior to most professional tools, such as Adobe Illustrator.

Most Microsoft Designer applications are available free of charge for iOS and Android, although some more specialised applications require a subscription through Capital Pro.

For more information, visit.

- "Frequently asked questions about Microsoft Designer". https://support.microsoft.com>en-gb
- "What is Microsoft Designer and who is it for?" https://www.dzteck.com
- "Microsoft Designer, a new era in the world of design". https://www.lovefortechnology.net
- "Microsoft Designer, via iOS and Android." https://gr.pcmag.com

2.2.6 Getting to know Gemini

Gemini is Google DeepMind's newest AI model family, introduced in late 2023 and constantly evolving. It is the successor to PALM2 and is the central "brain" behind many Google products and services.

Key features of Gemini:

- Multimodal: it can understand and generate different types of information - text, images, audio, video and code.
- **Scalable**: Available in different sizes (Nano, Pro, Ultra) for use from mobile devices to supercomputing data centres.
- **Programming-oriented**: It has strong code comprehension and generation capabilities, comparable to or even superior to other large language models.
- **Product integration**: Already used in Google Search (Search Generative Experience), Bard (also renamed Gemini), Pixel smartphones, and tools such as Google Workspace (Docs, Gmail, Sheets).
- **Designed for security:** Google has invested in "secure content filtering," bias control, and better management of sensitive topics.

In other words, **Gemini** is Google's answer to ChatGPT (OpenAI), but with a greater emphasis on seeing and hearing beyond text, so that it functions as a multidimensional application.

For more information, visit.

- "Getting to know Gemini". https://gemini.google.com/
- "Gemini for Students" https://gemini.google/students/;hl=en
- "Upload to Gemini applications documents, spreadsheetssheets, photos, videos and more to get answers, summaries, etc. https://support.google.com/gemini/answer/14903178;hl=en&co=GENIE.Platform%3DDesktop

KEY QUESTIONS FOR CHAPTER 2

After completing Chapter 2, participants should be able to give clear and specific answers to questions such as:

- How can Artificial Intelligence (AI) be used as a tool for improving education?
- Describe a way in which AI can help teachers.
- Formulate a way in which AI can help students.
- Why is it important to have a "balance" between the use of AI and human work?
- What does 'personalised learning' mean?
- Describe a risk of excessive use of AI by students.
- What do we mean when we say "digital literacy"?
- Why should students check the information provided by AI?
- Mention an AI tool that you know and use from the chapter and describe how you use it.
- Why should teachers explain how they use AI in their assessments?
- Which AI tool would you choose to prepare a presentation?
    - Text only
    - With text and photos
    - With text, photos and graphics
- Do you believe in 'lifelong learning' for yourself and others? Justify your answer. If the answer is "YES", how do you think you will achieve it?

CHAPTER 2 CONCLUSION

Artificial intelligence (AI) can act as a powerful accelerator of quality and equality in learning, but only when it is integrated with pedagogical purpose, transparency and clear ethical boundaries. The benefits of personalised teaching, more efficient resource management, and richer and more engaging material are important, but they coexist with real risks such as

- The undermining of critical thinking
- Over-dependence of teachers and students
- Issues of credibility and privacy
- Copyright issues.

This is why a balance is needed between the **power of tools** and **human judgement.**

The key to success is the upgraded role of the teacher, which is achieved through

- Continuous training in AI tools
- The ability to plan teaching and justify assessments
- Building trust with students and parents
- At the same time the students need to acquire systematic "**Digital Literacy**"
- Understanding how AI works and what its limitations are
- Critical evaluation skills
- Respect for personal data
- Developing social and emotional skills to avoid isolation and malicious use.

Education policy must ensure infrastructure, training and equal access so that the introduction of AI does not exacerbate inequalities between schools and sets clear rules for transparency, objectivity and ethical use. Modern tools (ChatGPT, Perplexity, Claude, Napkin, Microsoft Designer, etc.) are **useful means**, not **ends in themselves**. They are used to teach us **'how to learn**'. Ultimately, 21st-century schools must not turn their backs on AI; they must put it at the service of learning, with a focus on people, so that tomorrow's adults are capable, responsible and competitive in an ever-changing world.

3. Climate Change. Impacts and Predictions for the Future

CHAPTER 3 OBJECTIVES

Chapter 3 of our book has two main objectives.

- Objective 1:
  - To provide basic scientifically documented knowledge that defines the term "climate change" on Planet Earth from historical times to the present day.
  - To describe the main factors that have caused the climate change observed in recent decades.
  - To identify the effects of climate change, mainly on human health.
  - Clearly describe the greenhouse effect
  - Make predictions about possible impacts in the near future
- Objective 2:
  - Provide ideas to teachers so that they can organise activities with their students /their students (Model Lesson) on Climate Change.
  - Teachers should teach their students how to make the best use of AI tools to gather and present topics related to climate change.
  - Teachers and students should collaborate in organising events to inform/raise awareness among students, teachers and social actors on issues
    - Climate Change
    - Environmental Protection

3.1 Weather – Climate – Climate Change

In order to talk about climate change, we must first define what "weather" and "climate" are. Weather is defined as the totality of meteorological phenomena (sunshine, rain, wind) over a short period of time, which can vary from day to day and even from hour to hour (WHO, teachers guide, 2008).

Climate is defined as the composition of weather in a region, as described by statistical data that describe weather changes over long periods of time, approximately thirty years (D. Melas, 2000). The main elements used to define climate are temperature, humidity, atmospheric pressure, air movement (wind), cloud cover, visibility and precipitation.

The climate on Planet Earth has never been stable. It has changed periodically, and the Earth has experienced both warm and cold periods. In recent years, however, there has been a sharp change in climate, which is due to human intervention (WHO, teachers guide, 2008).

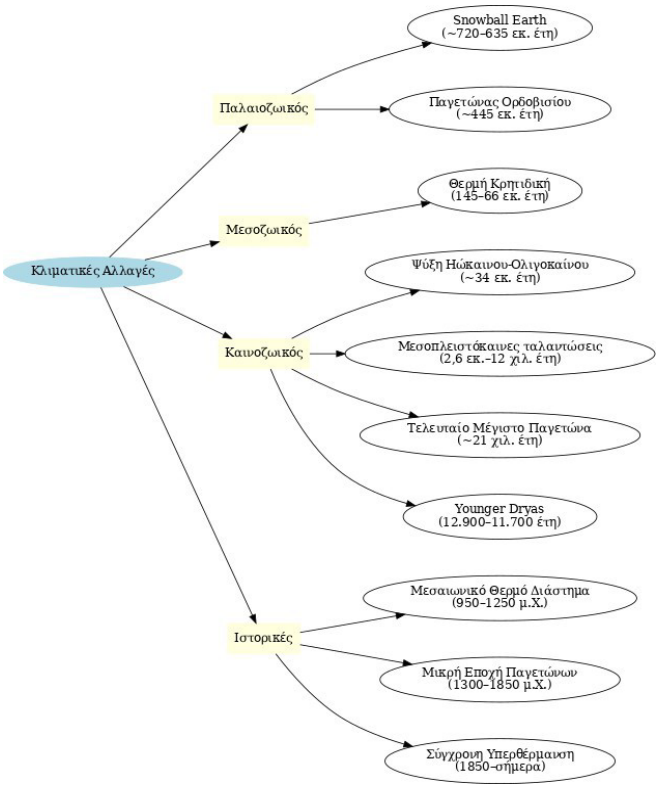
Climate change is the change in the global climate, and in particular the changes in meteorological conditions that extend over a long period of time. Such changes include statistically significant fluctuations in the average state of the climate or its variability, extending over decades or more. Climate change is caused by natural processes as well as human activities that affect the climate, such as changes in the composition of the atmosphere. In the United Nations Framework Convention on Climate Change (UNFCC), climate change is specifically defined as a change in climate that is directly or indirectly attributable to human activities, distinguishing the term from climate *variability*, which has natural causes.

The most significant climate changes in the history of planet Earth and their causes are as follows:

1 Climate Change in the History of the Planet

Important periods in the history of our planet are:

- Our Earth has existed for 4.6 billion years and has gone through various phases.
- In the beginning, for hundreds of millions of years, it was a hell of lava and toxic gases.
- For 3 billion years, there was no possibility of survival on the Earth's surface.
- Earth's climate during 75% of its existence was in a **"greenhouse" state** with high temperatures, tropical conditions and no ice at the poles.
- There were **ice** ages when the ice extended quite far from the poles.
- During **the "freezing" phase,** the entire Earth was covered by ice. This phase has only occurred twice and has lasted several tens of millions of years each time.
    - **Until 50 million years ago, it was in a greenhouse phase and gradually began to cool.** This is when the giant ice sheets in Antarctica and Greenland were formed and the ocean at the North Pole froze.



The causes of climate change recorded in the history of the Earth are mainly

- **Periodic changes in the Earth's orbit,** which greatly affect which areas of the planet receive more or less radiation.
- **Solar radiation** fluctuates, and with it the amount of energy that reaches Earth.
- **The greenhouse effect**: As gases such as carbon dioxide (CO2) and methane (CH4) accumulate in the atmosphere, more solar radiation is trapped near the Earth's surface, resulting in an increase in temperature.

- Throughout most of Earth's history, **the** concentration of such gases in the atmosphere **has fluctuated** through natural processes lasting **hundreds of thousands or millions of years**.
- **Large climate systems** (natural cycles) vary, creating conditions for climate change. At the same time, human activities create conditions for climate change

Climate change is not synonymous with an increase in the Earth's average temperature, but it is closely related to it. The increase in the average temperature of our planet leads to a series of meteorological phenomena which, when observed over long periods of time, constitute global climate change (WHO, teachers guide, 2008).

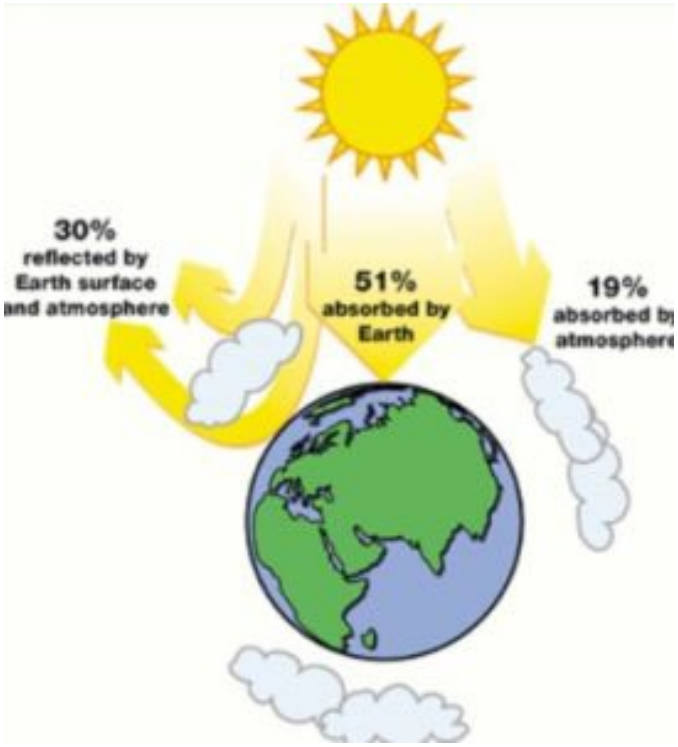
Climate change has an impact, to a greater or lesser extent, on all living organisms and ecosystems. Specifically, it leads to the collapse of ecosystems, the extinction of many species and a reduction in biodiversity.

At first glance**, climate change** seems like something completely outside of everyday life. However, exposure to extreme environmental conditions due to global climate change is now very common. Weather-related disasters such as hurricanes and torrential storms, floods, droughts and fires are now part of everyday life.

We are all exposed to **climate change** through our daily activities, even if we do not realise it. In fact, it is a constant and daily experience for all of us. However, children are the most exposed, especially those who, for whatever reason (poverty), are socially excluded (Balk S.J. The clinical environmental history: Experience of the USA).

3.2 Internal and external factors contributing to climate change.

The Earth's climate has been changing constantly, at varying rates, since the beginning of the world. However, these fluctuations have been slow compared to the current ones. Taking into account the 'time scale' of the changes, we can understand the different effects of natural and human activities and whether they are causes of the climate crisis. In any case, a key parameter is the average temperature, which is regulated by the balance between incoming and outgoing energy, which determines the Earth's energy balance.



Scientists generally agree that no single model can explain the climate changes that have occurred on Earth. For this reason, various mechanisms have been proposed to explain these phenomena, including astronomical ones. Any factor that causes a change in the amount of incoming or outgoing energy, which is maintained over a long period of time (decades or more), can lead to climate change.

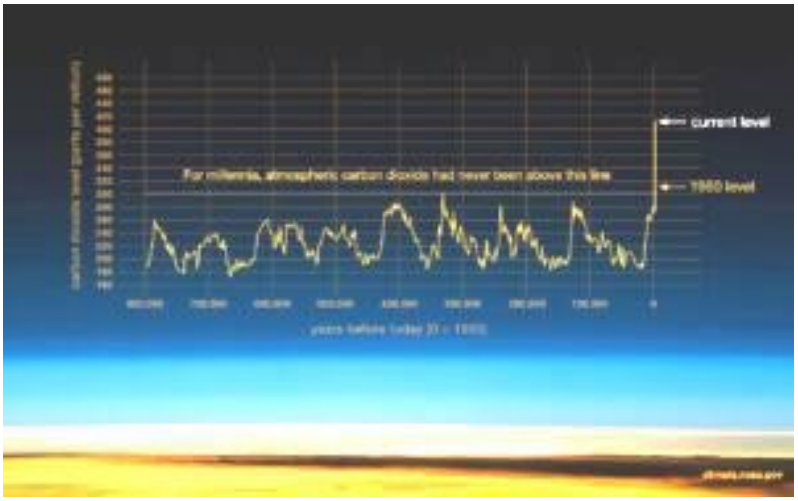
3.2.1 Endogenous Factors

Some of the natural (internal) factors related to climate change are **volcanic activity, atmospheric circulation, solar radiation and changes in the Earth's orbit around the Sun**. These factors have the following effects:

- Volcanoes lead to a decrease in temperature. This is due to the particles of pollutants released into the atmosphere, which reduce the amount of solar radiation reaching the Earth. Large volcanic eruptions that emit huge amounts of dust and sulphate compounds cool the atmosphere. This has relatively short-term effects on the climate, lasting from a few months to a few years.
- Fluctuations in ocean currents or atmospheric circulation (e.g. the El Niño phenomenon) can also affect the climate for short periods of time. Although these variations are important because of their impact on human activities, causing warmer years and more severe droughts or heavier rainfall, this natural internal variability of the climate does not contribute to the long-term trend.
- Changes in solar radiation have generally contributed to climate trends over the last few centuries. However, since the Industrial Revolution, the increase in greenhouse gases in the atmosphere has had about 10 times more impact on "climate forcing" than variations in solar radiation.
- Widely accepted on this subject is the theory of Serbian astrophysicist Milutin Milankovitch, who believes that the cause of variations in solar radiation, and therefore climate, is changes in the Earth's orbit around the Sun. The theory links the Earth's movements (eccentricity, obliquity, axial precession) to long-term climate change, based on seasonal and latitudinal variations in the solar radiation received by the Earth.

3.2.2 Exogenous Factors

- It has been scientifically proven that natural changes alone are not sufficient to explain the temperature changes over the last 50 years. Using computer models, the various parameters of climate deterioration (natural and anthropogenic) in the recent past are reproduced.
- When climate models include only natural factors (such as variations in solar intensity and volcanic eruptions), they cannot accurately reproduce the temperature increase observed over the last half-century. When anthropogenic climate factors (greenhouse gases) are included in the models, they are able to reproduce the recent increases in atmospheric and ocean temperatures.
- When comparing natural and anthropogenic factors, the dramatic accumulation of carbon from human sources is by far the most significant cause of climate change over the last 50 years. As shown in the diagram below, CO_2 levels had never risen above 300ppm in the previous 800,000 years, but since 1950 they have been rising steadily and have now exceeded the critical safety threshold of 400ppm.



Exogenous factors in the climate system are also referred to as **"climate aggravating factors",** based on the view that they are driving the climate towards a new, long-term state. Different factors operate on different time scales, and not all of those that led to changes in the Earth's climate in the distant past are related to those of contemporary climate change.

3.2.3 The Responsibility of Human Activities for Climate Change

Let us now examine how and to what extent humans are responsible for the occurrence of climate change by studying different natural factors as well as other natural phenomena and comparing them with human activities.

- **If** the increase in temperature is due to **the increase in energy coming from the Sun**, **then** all layers of the atmosphere **would be warmer**, **not just the troposphere** where CO2 is found.
- Scientific measurements of **the energy emitted by the Sun** show that **it has been decreasing** since the **1970s**.
- In relation to the **change** in the Earth's **orbit**, **we have been in a phase of** global **cooling** for the last 8,000 years. According to calculations, we will enter a phase of warming after about 15,000 years.
- **Natural cycles** have a much greater impact on the areas closest to where they occur. However, we are seeing **an increase in temperature across the ENTIRE planet**. After all, El Niño is now on the wane.
- **Carbon** exists in nature in **three** different **isotopes**: C-12, C-13, and C-14. C-14 is related to radioactivity and increased rapidly after nuclear testing.
- **Plants prefer** the **C-12** isotope for photosynthesis.
- Fossil fuels derived from plants **increase** the **C-12/C-13 ratio**, a fact that **has been** scientifically **verified**.
- **A similar concentration** of CO2 existed **15 million years ago**. The temperature rose by 5°C and the sea level rose 60 m higher than it is today. But **the whole process lasted** 100,000 years!
- Today, we **emit CO_2 10 times faster** than we did back then.
- Based on current data, therefore, the Earth's temperature should **be decreasing** rather than increasing.

The fairest way to assign responsibility is:

- By controlling each country's annual emissions.
- By monitoring state **industrial production within its borders, as well as production carried out by the same state in another country.**
- By calculating the **cumulative amount** that has **already been emitted**
- By converting greenhouse gas emissions **per capita**.
- **The richest** countries are **more responsible** for the 50 gigatonnes of CO2 equivalent emitted than the poorest countries, **and the most populous** countries are more responsible than the others.
- **The richest 10%** of the world's population **emits 50%** of CO2, while **the poorest 50%** emits **only 7%**!
- **China currently** emits **the most (33%)** of global emissions, but it is a populous country.
- **The US**, with 4% of the world's population, has **already emitted >** 25% of gases, and **the EU,** with 7% of the population, **> 20%.**
- China has contributed 12.7%, Russia 6%, India 3% and the whole of **Africa and South America just 6%.**
- In **Paris** in **2015**, 195 countries decided to limit the increase in average temperature to **<2**°C compared to the level **before** the **Industrial Revolution**.
- There were strong reactions, especially from Pacific island **states**, **which are threatened by rising sea levels** and would be wiped out by the waves if the above limit were exceeded.
- So **they settled on a limit of ≤ 1.5°C,** which was considered reasonable and achievable.
- **However,** this requires **us** to **reduce** global CO2 emissions by **45% by 2030** and to **zero by 2050**.
- We must keep the concentration **below 500 ppm until 2100,** but **today** we are already recording **427 ppm**.
- An increase of 2°C would cost the global economy $5 trillion per year (Australian research).
- In 2021, it was estimated that by **2100 we will have room** to emit **another 580 gigatonnes of CO2** (carbon budget).
- However, we have already sent **100 megatons in the first three years**!
- **89%** of known **coal deposits** (lignite, hard coal, etc.) **should not be burned**.
- **58%** of known oil deposits and **56%** of natural gas deposits should remain unexploited.
- **However, fossil fuel companies** consider these **quantities** to be **their property,** and states calculate them as a source of income!

3.2.4 Other Effects of Climate Change

The general effects of climate change are many and appear in different parts of our planet, such as:

Ice melt in Greenland

- The **amount of water** in the world is **constant**.
- **Ninety-seven per cent** of water is found in the **oceans**.
- During the Ice Age, some of this water fell as snow on land, **froze and remained there,** causing sea levels to gradually fall. **Twenty** thousand years **ago,** 4% of the water was locked up and the **sea level was 130 metres lower** than it is today.
- **The melting** of ice **on land** is a major problem.
- **The ice sheet covering 80% of** Greenland is twice as high as Mount Hymettus, spread over an area three times the size of the Balkans (2,500 km long, 1,100

km wide, 2 km thick).

- **If** all this ice melted and flowed into the sea, the global sea level **would rise by 7 metres**!
- However, **this has not happened** in the last 10-15 million years!

Ice melt in Antarctica

- Two-thirds of the planet's fresh water is found in Antarctica.
- It covers an area larger than Europe, with ice thicknesses of 4.5 km in some places. If all this ice melted, sea levels would rise by 58 metres! This has not happened for 45 million years.
- The smaller the area of ice cover, the less solar radiation is reflected and the more is absorbed by the sea, resulting in an increase in temperature.

3.2.5 Climate Change and Human Health

Climate change affects not only ecosystems and biodiversity, but also health. Many diseases are particularly sensitive to temperature change. These include communicable diseases such as malaria and dengue fever, as well as eating disorders, mental illness, cardiovascular disease and respiratory diseases (WHO, teachers guide, 2008).

a. Respiratory Diseases, Allergies

Respiratory diseases are characterised by difficulty in breathing and reduced oxygen levels in the bloodstream. Respiratory problems are a major cause of death in developing countries and are also a concern for children in developed countries. Since 1980, the incidence of asthma has quadrupled. Respiratory disorders such as asthma and allergies are caused by many factors. These factors can be genetic, behavioural or environmental. (WHO, teachers guide, 2008)

Allergy is a disease that mainly affects children. Pollution and the concentration of fungal spores and conidia in outdoor environments are some of the main allergens. Allergies in children include dermatitis, eczema, allergic rhinitis and asthma.

b. Diseases caused by the consumption of unsuitable drinking water.

These diseases are caused by the use of contaminated water, either through direct consumption or indirectly through the consumption of animals or plants that have consumed contaminated water. Of all the diseases caused by contaminated water,

diarrhoea appears to be the leading cause of death among young children. (WHO, teachers guide, 2008).
Diarrhoea is caused by a variety of pathogenic microorganisms. Protozoa, bacteria and viruses can cause diarrhoea. Rising temperatures lead to an increase in the concentration of these microorganisms in water and, consequently, to an increase in the number of patients. The spread of diarrhoea mainly affects developing countries due to poor quality control of drinking water. Once again, children appear to be the most vulnerable group, as they come into more contact with water through their play, while also having a more sensitive metabolism.

c. Malnutrition

Floods, drought, heavy rainfall, extreme weather events and climate change in general lead to a reduction in agricultural production and livestock farming, and therefore to a reduction in food availability, global hunger and malnutrition. In 1990, 520 million people were at risk of starvation, according to American and British scientists. Malnutrition and starvation affect all people without exception, but especially children. (WHO, teachers guide, 2008) Furthermore, hunger, which is largely due to climate change, remains a major cause of war and migration. (Zhang, 2007)

Abrupt climate change leads to a reduction in biodiversity. All organisms that have not developed adaptive mechanisms to abrupt change and are unable to migrate to other areas die, and entire species disappear. This also affects us. Animals are a source of food. Their extinction leads to a reduction in available food and therefore to hunger.

In addition, UV-B radiation kills microorganisms such as phytoplankton, zooplankton and marine plants, leading to a general decline in biodiversity. This reduction is a disruption of the ecosystem which, through the various interactions that exist in an ecosystem, can lead to malnutrition. (Häder DP, 2011)

d. Cardiovascular System Diseases

A sharp rise in temperature appears to strain the cardiovascular system, causing exhaustion, strokes and even death. (WHO, teachers guide, 2008) A sudden increase in temperature (heat stress) is a risk factor for the elderly and those who are vulnerable. There are differences between the estimated risk faced by vulnerable population groups. These differences depend on the climate and cultural factors such as the type of housing.

e. Infectious diseases

The predicted increase in communicable diseases as a result of climate change poses the threat of a social crisis. History has shown that epidemics have erupted after abrupt climate change in a non-linear manner. Climate change affects the incidence of communicable diseases either directly, by influencing the life cycle of pathogenic microorganisms, or indirectly, by influencing the life cycle of intermediate hosts. An increase in atmospheric humidity, caused by rising temperatures, for example, is associated with the emergence of diseases such as typhoid and cholera (WHO, teachers guide, 2008). The increase in cases of communicable diseases may also be due to an increase in the number of intermediate hosts of pathogenic microorganisms, i.e. insects and mosquitoes. The frequency of intermediate hosts also depends on temperature. These diseases include malaria, dengue fever, encephalitis, schistosomiasis and yellow fever (WHO, teachers guide, 2008).

g. Mental illnesses

Extreme weather events such as cyclones, hurricanes, torrential rains, sudden sea level rises and droughts lead to psychological stress. People die, are injured, families are torn apart, children are orphaned, and in the best-case scenario, taxes cannot be paid due to the destruction. All of this affects mental health. The sudden and unpredictable change in the environment mainly affects mental health, causing post-traumatic stress disorder (PTSD). People who have suffered this type of trauma exhibit confused behaviour. They show fear, sadness, terror and aggressive behaviour. The symptoms may appear months or even years after the event. Children in particular try to avoid coming into contact with the area where the trauma occurred. This leads them to migrate. Children who migrate after a natural disaster are very likely to be orphans. Their migration is a major social problem as it is linked to school dropouts and an increase in crime. (WHO, teachers guide, 2008)

Climate change, characterised by floods, humidity and prolonged drought, has an impact on the mental health of farmers. Australia has the most variable climate in the world and is also a global producer of agricultural products. In Australia, farmers' stress is mainly related to prolonged drought. Factors contributing to the disruption of farmers' mental health include reduced access to health services, a stoic culture and, more generally, inhibitions about seeking help.(Berry HL, 2011)

3.3 Climate Change and Natural Impacts

a. Effects of Temperature Change

- The increase in global average temperature leads to more frequent **extreme temperatures** that can cause increased **mortality**, **reduced productivity** and **damage to infrastructure**. The most vulnerable members of the population, such as the elderly and infants, will be most affected.
- Higher temperatures are likely to cause a change in the geographical distribution of climate zones. These changes alter the **biogeography** (distribution and abundance) of plant and animal species, many of which are already under pressure from habitat loss and pollution.
- Temperature increases are also likely to affect the **behaviour** and **life cycles** of animal and plant species. This could in turn lead to increased numbers of pests and invasive species and a higher incidence of certain human diseases.
- Temperature affects the **yields** and **sustainability** of **agriculture** and **livestock farming**, or the ability of ecosystems to provide important services and goods, such as clean water or cool, clean air.
- Higher temperatures increase water evaporation, which, combined with a lack of rainfall, increases the risk of severe drought.
- Extreme low temperatures could become less frequent in Europe.
- Global warming affects the predictability of events and therefore our ability to respond effectively. Consequences of climate change: https://climate.ec.europa.eu/climate- change/consequences-climate-change_en

b. Effects on rainfall

According to the Clausius-Clapeyron equation, air can generally hold about 7% more moisture for every 1C increase in temperature. Therefore, a world that is about 4 degrees Celsius

warmer than the pre-industrial era would have approximately 28% more water vapour in the atmosphere. However, this increased moisture will not fall evenly across the entire planet. Some areas will see increased rainfall, while other areas are expected to see less due to shifts in weather patterns and other factors.
Rainfall is projected to increase at high latitudes, in the equatorial Pacific, and in parts of the monsoon regions, but will decrease in parts of the subtropics and in limited areas of the tropics.

Climate change projections (based on the high emissions RCP 8.5 scenario), comparing the historical period 1971-2000 with the future period 2071-2100, suggest that average annual rainfall will decrease by 10-30% in many areas of southern Europe and by more than 30% in the south-eastern and south-western Mediterranean.
In addition, a more pronounced decrease is expected in the summer period, as summer rainfall is expected to decrease by 20-40% in a large area covering southern and western Europe, the Balkans and the Black Sea.
Reduced rainfall leads to increased drought throughout the year, particularly in areas with a subtropical climate, such as the Mediterranean regions.
Higher temperatures lead to increased evaporation, resulting in soil drying, reduced plant production and impacts on agriculture, even in areas where no major changes in rainfall are expected (such as central and northern Europe).

c. Impact on the number of fires

The impact of climate change on the number of fires has been particularly evident in recent years.
In the first half of 2019, the number of forest fires recorded in the EU was three times the average for the last decade. Mediterranean countries such as Portugal, Spain, Italy, Greece and France are currently more prone to fires and account for around 85% of the total area burned in Europe. In 2018, vulnerable ecosystems in the Natura 2000 network, which are home to several endangered plant and animal species, lost 50,000 hectares to fires, representing about one-third of the total area burned.
The number of days per year with high to extreme fire risk is projected to increase almost everywhere in Europe as a result of higher temperatures and increased periods of drought.
Only in scattered areas of northern Europe are small decreases predicted. The fire risk will worsen particularly in southern Europe, which already experiences high fire risk conditions more frequently.

d. Impacts on Sea Level Rise (SLR)

The main factors contributing to the average rise in sea level are due to temperature increase and are:

- Thermal expansion of water
- The melting of glaciers
- Changes in land-based water reservoirs (lakes, rivers, aquifers, etc.)

Europe is expected to experience an average sea level rise of 60 to 80 centimetres by the end of the century, depending on the rate at which the Antarctic ice sheet melts.
Around one third of the EU population lives within 50 kilometres of the coast, and these areas generate over 30% of the Union's total GDP. The economic value of assets within 500 metres of Europe's seas is estimated at between €500 and €1,000 billion. Along with other impacts of climate change, sea level rise will increase the risk of flooding and erosion around the coast, with significant consequences for people, infrastructure, businesses and nature in these areas.
As seawater pushes further into underground aquifers, this is likely to lead to much greater intrusion of salt water into freshwater layers, affecting agriculture and drinking water supplies. It will also affect biodiversity in coastal habitats and the natural services and goods they provide. Many wetlands will be lost, threatening unique bird and plant species and removing the natural protection these areas provide against storms.

e. Impacts on Extreme Natural Events

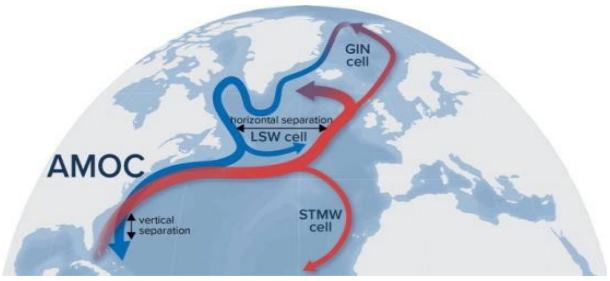
Climate change has already increased the size and frequency of extreme hot events and reduced the size and frequency of extreme cold events, and in some areas has intensified extreme rainfall events. As the climate moves away from its past and current state, we will face extreme events that are unprecedented in magnitude, frequency, timing, or location. The frequency of these unprecedented extreme events will increase as global warming intensifies. Furthermore, the combined occurrence of multiple unprecedented extremes can lead to large and unprecedented impacts.
In most regions, the frequency and intensity of extreme heat events have increased and those of extreme cold events have decreased. The frequency and intensity of heavy rainfall events have increased globally and in most land areas. Although extreme events such as land and marine heatwaves, heavy rainfall, drought, tropical cyclones, fires and coastal floods have occurred in the past and will continue to occur in the future, they often occur with different magnitudes or frequencies in a warmer world.
Unprecedented extreme events – i.e. events that we have not observed in the past – will occur in the future in five different ways:

- events that are considered extreme in today's climate will occur in the future at unprecedented magnitudes.
- Future extreme events will also occur with unprecedented frequency.
- Certain types of extreme events may occur in areas that have not previously experienced such events. For example, as sea levels rise, coastal flooding may occur in new locations, and fires are already occurring in areas, such as parts of the Arctic, where the likelihood of such events was previously low.
- Extreme events may also be unprecedented in terms of their timing. For example, extremely high temperatures may occur either earlier or later in the year than in the past.
- Composite events involving multiple extreme events of different or similar types may occur simultaneously and/or sequentially and may be more likely or more severe in the future. These complex events can often affect ecosystems and societies more severely than when such events occur individually. For example, a drought combined with excessive heat will increase the risk of fires and damage or losses to agriculture.

f. Impact on the AMOC system

Natural systems (ice sheets, permafrost, the Amazon rainforest, coral reefs, major ocean currents, etc.) are essential for shaping and maintaining the climate.

- All these systems are interconnected and influence each other.
- The danger is that many of these systems have tipping points, where once their limits are exceeded, very intense (sometimes irreversible) changes can occur.

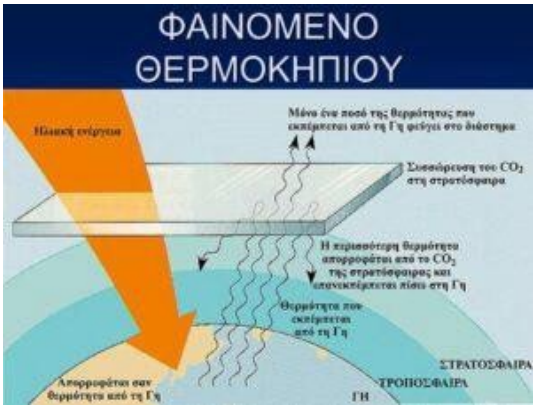


- The **AMOC** (Atlantic Meridional Overturning Circulation) system transports warm, salt-rich water from the tropical zone to the North Atlantic and returns cold water to the south.
- The salinity of seawater is approximately 3.5%.
- When it reaches Greenland, it cools, becomes even **denser**, **sinks** deep below the surface and returns southwards.
- This system is self-regulating and functions like a huge conveyor belt.
- It keeps large European cities, such as London, mild, even though they are geographically further north than cities in Canada, which freeze in winter.
- Climate change has weakened the AMOC by 15%.
- Increased ice melt in the North is causing **significant volumes of fresh water** to **be released** into the oceans.
- **Fresh water** is lower in salts and therefore less dense than sea water, making **it difficult to sink** and return south.
- Some scientists believe that the risk of collapse is low until the end of the century, but others believe that this is likely to happen within the next 80 years.

  If it collapses, London will experience winter temperatures of -17°C and sea ice will extend as far as Scandinavia.

3.4 Greenhouse Effect

In the previous pages, we referred to the effects that climate change has had on certain characteristics of our planet and the people who live on it. The main cause is the rise in the Earth's average temperature, which is mainly due to the greenhouse effect, caused by humans and human activities.



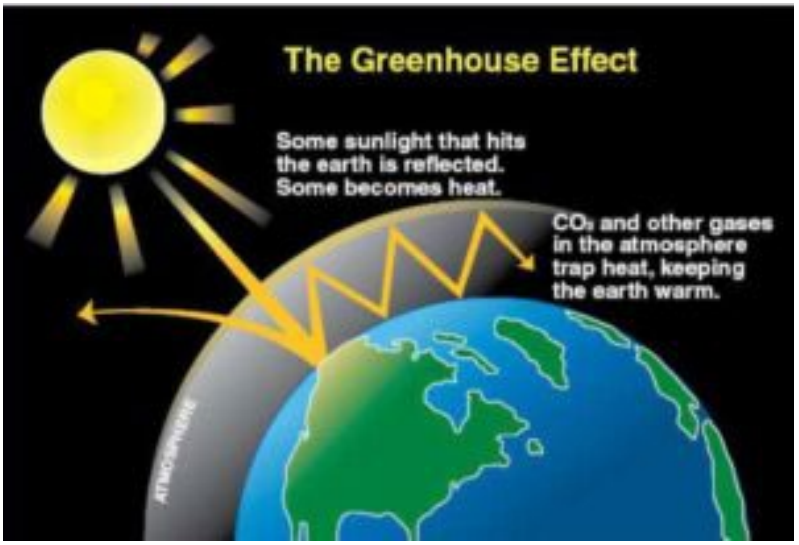
Humans are increasingly affecting the Earth's climate and temperature through the use of fossil fuels, deforestation and livestock farming, activities that add huge amounts of harmful gases to the atmosphere, causing global warming.

Atmospheric gases absorb the sun's thermal energy and prevent heat from escaping the atmosphere. In other words, they trap heat and keep it close to the Earth, preventing it from escaping into space.

This is directly related to the Earth's heat balance, which is as follows: of the 100% of total incoming radiation, the Earth's surface absorbs 51%, 19% is absorbed by clouds and the atmosphere, while 30% is reflected back into space by clouds, the atmosphere and the Earth's surface.

The gases in question (greenhouse gases) already existed in the atmosphere in a constant balance, but some of them become harmful due to their increased concentration as a result of human intervention. These are mainly: carbon dioxide, methane, nitrogen oxides and chlorofluorocarbons.

Carbon dioxide (CO2) is the greenhouse gas most commonly produced by human activities and is responsible for 63% of global warming of the planet. Its concentration in the atmosphere is now 40% higher than at the beginning of industrialisation.



Othergreenhouse gases are released in smaller quantities but trap heat much more heat or in some cases are stronger and have a longer lifespan. Methane is responsible for 19% of global warming from human causes and nitrous oxide for 6%.

The lifespan of the main greenhouse gases is therefore crucial. It is presented here below:

Carbon dioxide: it is not destroyed but follows the carbon cycle and can remain in the atmosphere for thousands of years

Methane: 12.4 years

Nitrogen oxides: 121 years

Chlorofluorocarbons: from a few weeks to thousands of years

More specifically, pollutants per category result from:

Burning fossil fuels (coal, oil, and natural gas) for industry, transport, electricity, and other activities that produce carbon dioxide and nitrogen oxides.

Deforestation also increases CO2 levels because it stops photosynthesis, through which plants absorb carbon dioxide and release oxygen into the atmosphere. When trees are cut down, the carbon that would have been stored in them is released into the atmosphere.

Methane is produced by landfill, livestock farming (animal waste), agriculture and land use changes (CH4). Nitrogen fertilisers are responsible for nitrous oxide emissions.

Industrial fluorinated gases have a huge warming effect, up to 23,000 times greater than CO2.

From the 1970, the realisation that economic growth has a negative impact on the environment became a fact. Despite pressure for ecological improvement, no action is taken because of the terrible dilemma: economic growth or environmental protection? Official bodies initially downplayed the effects of environmental pollution, until (even in Greece) people began to die from causes that were clearly linked to a combination of pollution and heatwave. In Athens, during the deadly heatwave of 1987, more than 1,300 people lost their lives when the temperature reached 44°C for eight consecutive days. Today, it is scientifically proven that there is a more than 95% probability that human activity is responsible for global warming of the planet over the last 50 years. Industrial activities have increased atmospheric CO2 levels from 280 ppm (parts per million) to 412 ppm over the last 150 years.

3.5 Predictions for the Future due to Climate Change

In recent decades, we have been experiencing an extensive climate crisis, which has had various effects on humans and natural systems on all continents. The temperature in the atmosphere is rising, permafrost is melting, sea levels are rising, heatwaves are occurring in Greenland, deadly fires are burning in Siberia and the Amazon, droughts in East Africa, unusual rains and heatwaves with devastating effects, longer and more intense heat waves in many parts of the planet.

Many terrestrial and aquatic species have already migrated in order to cope with and adapt to climate change. Those species that ultimately fail to do so will eventually disappear. The pace of climate change is rapid, making it even more difficult for species to adapt, with global warming being the most significant factor in their extinction. Many species living on land or in fresh and salt water have already moved to new areas.

Scientists confirm that the planet's temperature will continue to rise in the coming decades, mainly due to the greenhouse effect and anthropogenic emissions. The Intergovernmental Panel on Climate Change (IPCC) predicts a temperature increase of up to 4°C over the next century, i.e. 1-3°C above 1990 levels, with negative effects on all areas of the environment, health, society and the economy.

The extent of climate change in the coming decades depends mainly on the amount of heat trapped by greenhouse gases emitted globally, due to the sensitivity of the Earth's climate to these emissions. According to the IPCC, the spread of the effects of climate change in individual regions will vary not only with the physical manifestation, but also with the social and environmental policies pursued by each region to adapt to climate change. In any case, the solution lies in adapting natural and human-made systems to current or expected climate events and their impacts in a way that mitigates damage or exploits opportunities.

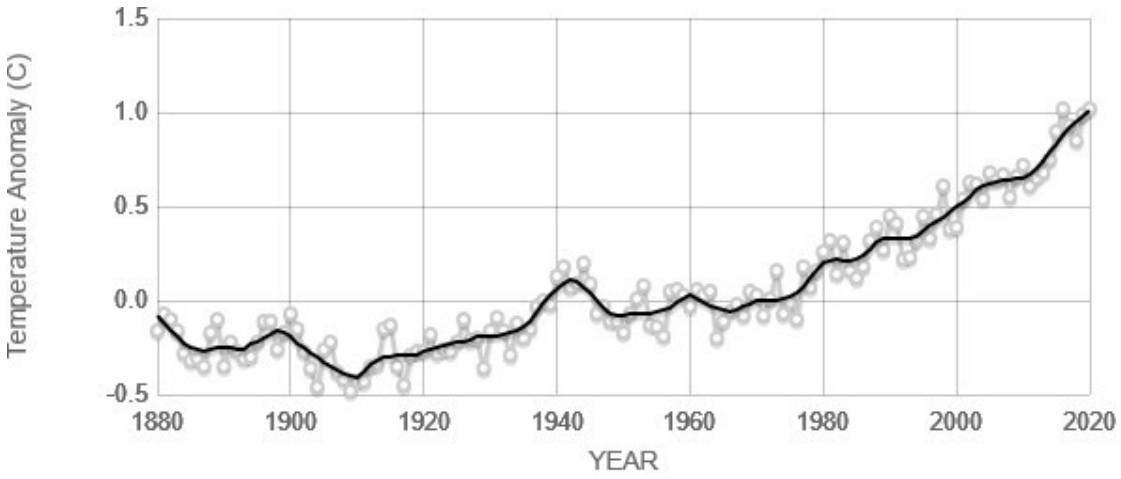
In this context, and in line with international policies, the National Strategy for Adaptation to Climate Change (ESPKA) was drawn up for Greece and approved by Law 4414/2016, Articles 42-

45. Government Gazette A' 149, the National Strategy for Adaptation to Climate Change (ESPKA), which aims to set guidelines. It includes sectoral actions and measures in 15 sectoral policies, including coastal zones. The Regional Climate Change Adaptation Plan (PESPKA), which is being developed at regional level, serves the same purpose.

Climate change also gives rise to unpleasant situations related to health. There has already been an increase in deaths from heat waves, floods, storms and other natural disasters caused by extreme weather events resulting from climate imbalance. At the same time, there are already changes in the distribution of certain waterborne diseases and changes in disease vectors, with dramatic consequences such as the recent Covid-19 pandemic, which spread across the globe.

The average surface temperature of the planet has increased by about 0.9 degrees Celsius since the mid-19th century, a change that is mainly due to CO2 and other anthropogenic emissions into the atmosphere. The largest increase has occurred in the last 35 years, with the five warmest years recorded since 2010.

The graph below clearly shows that temperature increases cannot be explained solely by natural processes, but only when human intervention is added to the equation.



Source: climate.nasa.gov

a. Predictions for Drought and Heat Waves

These are expected to become more intense, while cold fronts are expected to decrease everywhere. Summer temperatures in particular are expected to continue to rise. By the end of this century, what has been observed once every 20-30 years (one day of heatwave) is expected to be recorded every two years across the territory. Thus, record temperatures in Europe exceeding even 40 degrees Celsius, storms and gusts of wind, polar bears forced to search for food in populated areas.

In simple terms: global warming will not happen. It is happening now! According to the latest scientific findings, we have only 10 years to reduce global greenhouse gas emissions and about 25-30 years to eliminate them.

b. Predictions for Sea Level Rise

The melting of ice and the expansion of ocean water as a result of heat absorption at the upper 700 m are the two main reasons for sea level rise.

Sea levels have already risen by 20.32 cm over the last century (since 1880), according to official data. However, the rate has doubled in the last two decades and continues to accelerate each year, so that it is expected to rise by another 0.3 m to 1.2 m by 2100. Sea level rise will continue after 2100 because the oceans are slow to respond to the warming of the Earth's surface.

The consequences of both long-term sea level changes and temporary extreme events affect many sectors of the economy, including tourism, land use and transport. The total cost of anthropogenic sea level change amounts to tens of millions of euros per year.

In the coming decades, storm surges and high tides may combine with rising sea levels and coastal sediment erosion, resulting in flooding in many areas.

c. Forecasts for rainfall patterns

Average rainfall has increased since 1900, but some areas have higher than average rates and some have lower rates. In the future, rainfall will vary in quantity and extreme rainfall events will certainly occur more frequently.

However, changes in rainfall, snowfall and the shrinking of Alpine glaciers are causing flooding and deterioration in water quality, but at the same time, paradoxically, a reduction in water resources. Heavy rainfall and other extreme weather events are becoming increasingly frequent. Extreme rainfall does not mean an increase in the amount of water, due to its uneven spatial and temporal distribution.
Numerous climate scenarios for rainfall change from 2015 to 2084 have been studied Below are two different scenarios for rainfall development based on the greenhouse effect, with the following characteristics:
Scenario B1 – optimistic: lower greenhouse gas emissions (with emphasis on the environmental sector)
Scenario A2 – pessimistic: higher greenhouse gas emissions (with emphasis on the socio- economic sector)

d. Consequences of climate change in Southern Europe

Many scientists are drawing attention to the situation in the Mediterranean and in the countries of Southern and Eastern Europe, with a population of approximately 450 million:

- **Southern and Central European** countries are increasingly affected by heat waves, forest fires and droughts.
- **Northern Europe** is receiving higher amounts of rainfall, and flooding will become a common occurrence in winter.
- **Urban areas**, where 4 out of 5 Europeans now live, are exposed to heatwaves, floods or rising sea levels, but are often not adequately prepared to adapt to climate change.
- While wealthy **coastal countries** are doing enough to protect the ecosystem, other countries are far from doing so. Countries in the southern and eastern Mediterranean have little capacity to analyse this threat to their territories, putting them at greater risk!
- Water will become a precious commodity. **Water scarcity** in the Mediterranean region is constantly increasing, resulting in a greater risk of drought and uncontrolled fires.
- The risk **of desertification** in large parts of Southern Europe and North Africa is now visible, which, among other things, will have a major impact on biodiversity.
- Since the 1970s, water temperatures have risen by 0.5 degrees Celsius.
- Global warming is having a greater impact on the Mediterranean than on other regions. **The sea level** rose by 2.5 mm/year between 1950 and 1970, and by 10 mm/year between 1990 and 2007.

Even if the goal is to keep the global temperature rise below 2 degrees Celsius, average temperatures in many parts of the world will exceed this. There is a direct, linear relationship between overall climate change and temperature changes in different regions and in the world as a whole. Extreme values change disproportionately in some areas.

e. Consequences of Climate Change in Greece

Due to its geographical location, between temperate Europe and the desert of North Africa, Greece belongs to a region that is considered to be "in the red", i.e. among the areas most affected by the impacts of climate change. The environment of Greece also has great biodiversity and different climatic characteristics, due to:

- the interaction between weather systems,
- the complex topography and
- the distribution of land and sea from west to east and from north to south

Thus, within a few tens of kilometres, climatic characteristics can change from coastal Mediterranean type to even alpine type in the central and northern regions of the country.
This diverse topography divides the body of Greece into the western rain shadow and the eastern rain shadow (where rainwater is the source of water).
The total volume of water received by our country per year averages 115 billion cubic metres. This volume is not inferior to that of many other European countries. However, there is a water deficit, especially in the eastern part of the country (east), where the reduction in water availability is more pronounced, not only due to the inappropriate management of water resources but also due to extreme climatic conditions (in a single year, 1989-90, when rainfall decreased by about 40%).

Over the past century, rainfall has decreased by about 20%. It is expected that by the end of the 21st century, due to human intervention, rainfall will decrease by between 5% and about 20%, respectively, at the national level.
Another special feature of our country is its extremely long coastline, approximately 16,300 km. (about 1/3 of the planet's circumference). The vulnerability lies in the risk of a rise in the average sea level, which is estimated to range between 0.2 and 2 metres by 2100. Of course, the vulnerability of the coastline is not only determined by the risk of a rise in average sea level and extreme wave conditions, but also by other local factors, such as tectonic and geomorphological factors.
Approximately 20% of Greece's total coastline consists of coasts with moderate to high vulnerability to expected developments.
The consequences for coastal ecosystems, agricultural crops, elements of the Mediterranean diet, biodiversity and tourism in the country will be very serious. Many beaches are at risk of disappearing in the future, along with all the settlements on them, due to rising sea levels.
At the same time, the islands, Western Greece and Attica will face significant **drought** problems. The greatest increases in the duration of dry periods will occur in the eastern mainland and Northern
Crete, where 20 additional days of drought are expected by 2021-2050 and up to 40 additional days of drought by 2071-2100. The change in climatic conditions is expected to significantly increase the number of days with an extremely high risk of fire, by 40 days in 2071-2100 throughout

Recent impact of climate change in Greece and the disaster in Thessaly in 2023, known as the DANIEL phenomenon.
The main cause of the phenomenon is higher temperatures causing greater evaporation from the sea, resulting in the atmosphere having 7% more water vapour compared to
200 years ago. The clouds are heavier and there is **"massive"** rainfall, which is rather destructive.

- **In Thessaly in 2023,** over
  5 billion m^3 of water fell in Thessaly, an amount **of water that Attica consumes from EYDAP in 14 years!**
- There is the North Polar Air Current, which usually blows straight and continuously from west to east at a speed of 400 km/hour, like an **invisible border** between the cold north and the warm south.

- With climate change, the polar cycle warms more easily, so the jet stream weakens in intensity and straightness, forming curves and meanders (**omega obstruction**, because it resembles the Greek letter **omega)**.

This results in heat waves further north than usual, due to warm air, and similar weather phenomena south of cold areas.

3.6 Climate Change and Teaching in the Classroom Using Modern Technology and AI

The following information is contained in detail in the texts.

Skills Workshops
Thematic Unit: Caring for the Environment
by the Institute of Educational Policy of the Ministry of Education.

Classroom/Workshop Infrastructure and Worksheets provided by Teachers

a. Each class/workshop is organised into three parts.

- Introductory activity.
- Main activity on the topic of climate change
- Reflective activity and conclusion of the activity.

The teacher introduces the students to the basic concepts of topics such as climate change, the greenhouse effect, impacts, ecological awareness, actions, etc.
The necessary resources are a suitably equipped classroom or laboratory containing

- Technological equipment (computer, projector, printer, software)
- Software (internet connection, web browser, necessary AI tools for searching and processing information, necessary software).
- Educational material in various forms (printed books, electronic pages)
- Storage media (memory sticks, CDs, DVDs, etc.).

b. Worksheets

Examples of worksheets given by the teacher to students to help them organise their work

- Our planet and the historical changes that have been observed
- The future of our planet
- The greenhouse effect and what causes it
- Causes of climate change
- Consequences of climate change on health
- Alternative forms of energy (wind turbines, photovoltaics)
- What is the difference between weather and climate?
- Consequences of climate change
    - on fauna
    - On flora
    - Water scarcity
    - In the occurrence of extreme weather events.
- Actions by students and parents to limit the greenhouse effect.
- Suggestions you will make to your mayor to reduce pollution at the local level.
- Suggestions for reducing the overconsumption of energy, water and products in general at an individual and family level.
- Impacts of climate change on our city
- Suggestions for recycling materials at school and at home.

Here below we present examples for the Preparation and Educational Delivery of Environmental Education - Climate Change Workshops.

Model Lesson 1:
Title: "The Seasons Got Mixed Up"

Expected results:
The aim is for students to be able to

- Explore their initial ideas and knowledge about climate change and ask questions.
- Share thoughts and feelings, ideas, experiences and prior knowledge.
- Build new knowledge on existing knowledge in an exploratory and collaborative way.
- Experience communication, interaction and collaboration.
- Process information from sources and activate their critical thinking.
- Strengthen their interpersonal relationships and team dynamics.

Activities – (indicative)
This workshop introduces students to the topic of climate change in a natural way through reflection, dialogue, interaction and communication, sharing their interests in engaging with it.
Using a dialogue between children about climate change and excerpts from online sources, students study texts-articles on the subject, share comments and thoughts, and explore their initial ideas on the issue, recording them in a histogram of their initial ideas on climate change. What do they know, while formulating their questions about what they want to learn. The result of the workshop is the collective experience of the students and their level of understanding of climate change. This creates the canvas for building new knowledge.

Educational Material

- The warmest January in 135 years. Source: kathimerini.gr
- The warmest December in the last 160 years was recorded in Athens. Source: ethnos.gr
- In Finland, winter is so warm that birds are no longer migrating. Source: lAIfo.gr
  There are texts, excerpts, publications and articles from the electronic press that describe the observed climate change in our country and in various parts of the planet.
- Created using an online platform.Https://learningappa.org/watch?v=pf0apb6wk21

Presentation of the assignment:
Using the editing tools chosen by the students, they can present their work.

Sample Lesson 2:

Title: "The Climate Change Puzzle"

Expected results:

The aim is for students to

- To strengthen communication, cooperation and interpersonal relationships among themselves.
- Learn about the greenhouse effect and climate change.
- To link human activities with the increase in greenhouse gas concentrations.
- Discover the causes of global warming.
- Practise analysing and synthesising information from sources.
- To activate critical thinking.
- Develop expression and dialogue skills.

Activities – (indicative)

This is a workshop that involves students in investigating the problem of climate change and its connection to the greenhouse effect. Through the screening of an educational video, the study of relevant sources, dialogue and active interaction within the group. Students learn about the greenhouse effect and climate change, and reflect on human activities that contribute to the increase in greenhouse gases (transport, heating, factories), and investigate and discover the causes of global warming and climate change.

Educational Material

- European Commission text https://ec.europa.eu/assets/clima/ourplanet-ourfuture/ee
- European Commission text https://ec.europa.eu/clima/change/causec
- European Commission text https://ec.europa.eu/environment/global-challenges/consequences/index
- Educational video on the greenhouse effect that familiarises students with issues related to climate change,
  the greenhouse effect, etc. https://www.youtube.com/watch?v=IXtQCK9AG
- Educational video on global temperature changes from 1880 to 2018 NASA Climate Change https://www.youtube.com/watch?v=GxxOhoKiSs
- Text on "The Greenhouse Effect" National Observatory of Athens https://www.meteo.gr/pdg/thermokipio.pdf

Presentation of Work

Using the editing tools of their choice, students can present their work

Sample Lesson 3:
Title: "Climate Change is Here"

Expected results
The aim is for students to

- Strengthen communication and interpersonal relationships among themselves.
- To investigate specific issues related to climate change (impact on the environment and humans).
- Practise analysing and synthesising information from sources, cultivating their critical thinking skills.
- Be able to express their feelings and thoughts.
- To develop social skills, empathy and their creativity.
- Work together to achieve a common goal. One, two, three, four.

Activities – (indicative)
In this workshop, students have the opportunity to practise gathering and synthesising information from sources and written texts, to collectively discover aspects of the climate change problem (consequences for the environment and humans) and, through critical processing, dialogue and creative emphasis in various ways (dramatisation of dialogues, creative writing), to cultivate their communication, empathy, critical thinking and collaboration skills, as well as their creativity.

Educational Material

- European Commission text https://ec.europa.eu/assets/clima/ourplanet-ourfuture/ee
- European Commission text https://ec.europa.eu/clima/change/causec
- European Commission text https://ec.europa.eu/environment/global-challenges/consequences/index
- Educational video on the greenhouse effect that familiarises students with issues related to climate change,
  the greenhouse effect, etc. https://www.youtube.com/watch?v=IXtQCK9AG
- Educational video on global temperature changes from 1880 to 2018 NASA Climate Change https://www.youtube.com/watch?v=GxxOhoKiSs
- Text on "The Greenhouse Effect" National Observatory of Athens https://www.meteo.gr/pdg/thermokipio.pdf

Presentation of Work
Using the editing tools of their choice, students can present their work

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Sample Lesson 4:
Title: "Looking to the Future"

Expected results
The aim is for students to

- Be able to critically examine issues related to climate change and make predictions about the future
- Distinguish between what is possible and what is desirable, and seek solutions for a better future
- Discover policies and practices for adapting to climate change and mitigating its effects
- Develop communication, cooperation and collective solution-development skills
- Develop creativity (and digital skills) through concept mapping.

Activities – (indicative)
Students explore future scenarios for climate change. (First scenario: the situation will remain as it is. Second scenario: the situation will worsen. Third scenario: the situation will improve.) They distinguish between what is most likely and what is desirable, make predictions, decide on their future, and consider how we can achieve the desirable scenario.
They study texts and sources, learn about sustainable solutions and practices for adapting to climate change and mitigating its effects.
They record solutions and proposals and combine the nomenclature map of climate change with its most basic parameters. Such consistency, solutions in digital or printed form.

Educational Material

- European Commission text https://ec.europa.eu/assets/clima/ourplanet-ourfuture/ee
- European Commission text https://ec.europa.eu/clima/change/causec
- European Commission text https://ec.europa.eu/environment/global-challenges/consequences/index
- Educational video on the greenhouse effect that familiarises students with issues related to climate change,
  the greenhouse effect, etc. https://www.youtube.com/watch?v=IXtQCK9AG
- Educational video on global temperature changes from 1880 to 2018 NASA Climate Change https://www.youtube.com/watch?v=GxxOhoKiSs
- Text on "The Greenhouse Effect" National Observatory of Athens https://www.meteo.gr/pdg/thermokipio.pdf
- Material from the website https://go.bubbl.us/bb25gg/9867?/New-Mind-Map

Presentation of Work
Using the editing tools of their choice, students can present their work.

Sample Lesson 5:

Title: "Learning to protect the environment"

Expected results

The aim is for students to

- Be informed about Sustainable Development Goal 13: Climate Action.
- Connect climate change with its daily consequences (waste of energy and resources) and choose a lifestyle that addresses it.
- Make responsible decisions about actions that may affect the climate.
- Be able to take action to protect the climate at home and at school and make it a goal for today, as a stepping stone towards global goal 13.
- Work as a team and collaborate.
- Strengthen their communication, interpersonal relationships, critical thinking and creativity.

Activities – (indicative)

The workshop introduces students to global goal 13 of sustainable development (Climate Action) and helps them make the connection with how they can act on an individual level to support and defend it.

Through browsing sources, gathering information, reflection, dialogue and class discussion, students have the opportunity to explore solutions and decide on good practices for climate protection through simple changes in their daily lives and make them a goal for today as an action for global goal 13.

They strengthen their interpersonal relationships, cultivate cooperation skills and critical thinking, and apply themselves creatively by drafting a digital eco-code of good practices for climate protection.

Educational Material

- UN Regional Information Centre Https://unric.org/el
- European Commission text https://ec.europa.eu/assets/clima/ourplanet-ourfuture/ee
- European Commission text https://ec.europa.eu/clima/change/causec
- European Commission text https://ec.europa.eu/environment/global-challenges/consequences/index
- Educational video on the greenhouse effect that familiarises students with issues related to climate change,
  the greenhouse effect, etc. https://www.youtube.com/watch?v=IXtQCK9AG
- Educational video on global temperature changes from 1880 to 2018 NASA Climate Change https://www.youtube.com/watch?v=GxxOhoKiSs
- Text on "The Greenhouse Effect" National Observatory of Athens https://www.meteo.gr/pdg/thermokipio.pdf

Presentation of Work

Using the editing tools of their choice, students can present their work.

Sample Lesson 6:
Title: "Informing and Raising Awareness about Climate Change"

Expected outcomes
The aim is for students to:

- Experience participatory planning and organisation of an awareness-raising campaign on climate change.
- Make joint decisions and implement them, strengthening their social bonds.
- Be able to communicate the issue of climate change effectively.
- Take initiatives, develop teamwork and boost their self-confidence.
- To develop their poetic and strategic thinking and to unleash their creativity.
- To cultivate social social participation skills, as well as action, citizenship and digital skills.
- To work together to achieve common goals.

The workshop involves students in the collaborative and participatory design of an information and awareness campaign for the school and wider community on climate change. Students make joint decisions on how to "communicate" the issue of climate change to the school and local community, informing and raising awareness to proceed with the implementation of their actions, action groups, working together to achieve a common goal. The workshop involves all students, enhancing their personal empowerment, self-confidence in teamwork and social bonds within the class.

Educational Material

- Source Naftemporiki newspaper https://.naftemporiki.gr/story/i539584/peiragmenoi-diasimoi-pinakes-proidopoioun-gia-tin-klimatiki-allagi
- European Commission text https://ec.europa.eu/assets/clima/ourplanet-ourfuture/ee
- European Commission text https://ec.europa.eu/clima/change/causec
- European Commission text https://ec.europa.eu/environment/global-challenges/consequences/index
- Educational video on the greenhouse effect that familiarises students with issues related to climate change,
  the greenhouse effect, etc. https://www.youtube.com/watch?v=IXtQCK9AG
- Educational video on global temperature changes from 1880 to 2018 NASA Climate Change https://www.youtube.com/watch?v=GxxOhoKiSs
- Text on "The Greenhouse Effect"
  National Observatory of Athens https://www.meteo.gr/pdg/thermokipio.pdf

Presentation of Work
Using the editing tools of their choice, students can present their work.

3.7 The Role of the Teacher

The role of teachers is very important because they can contribute decisively to shaping social initiatives in their students, who will be tomorrow's adults and will participate to a greater or lesser extent in decision-making for the future.
With the information provided in Chapter 3, we want to raise your awareness of environmental protection issues and encourage you to study the relevant literature, research and conclusions in greater depth.

- Form heterogeneous groups of three to four students.
- Introduce the workshop topic and give a brief overview.
- Gives students ideas on where (internet or books) they can find information on the topic under development.
- Guides students with ideas for AI tools they can use to complete and carry out their work.
- Shows students how to use the features of an artificial intelligence tool of their choice.
- Guides the members of each team on how to complete and present their work to their students.
- Records the conclusions of each assignment, as well as the final conclusion.
- Asks students to express their opinions.
- Encourages discussion and the exchange of ideas, opinions and suggestions.
- Suggested questions. What did you learn, what did you achieve, what did you gain, what will you take away from the workshop?
- Encourage students to suggest ways of raising awareness among the general public about climate change and environmental protection.

3.8 Sources of information that students can use

As we already know, climate change is a social and scientific reality of our time with a variety of consequences. It is essential that we all have access to accurate and reliable information, and that the sources of this information are trustworthy.
The following suggested sources of information are considered reliable and can be used by teachers whenever they prepare assignments and lessons on climate change, or recommended to their students.

- Climate change 2023 Synthesis Report https://www.ipcc.ch/report
- Climate change disinformation and how to combat it 2021 https://doi.org/10.1146
- Science Education in an age of misinformation https://org./10.1002
- Public Engagement with climate change.
  What do we know and where do we go from here, 2013 https://doi.org/10.1386
- Creating a cloud map using the online platform https://learningapps.org/watch?v=pf0apb6wk21
- Educational video: Greenhouse effect NOESISSCIEN (duration 5.20). Available at https://www.youtube.com/watch?v=1ZtQCK9AG20
- Video: Changes in global temperature from 1880 to 2018 (0.33) NASAClimateChange. https://www.youtube.com/watch?v=gXXOkhoki8s
- The Greenhouse Effect Source: National Observatory of Athens. https://www.meteo.gr/pdf/thermokipio.pdf Source: European Commission https://ec.europa.eu/assets/clima/our_planet_our_future/el/files/assets/basic-html/page5.html

3.9 Ideas for Organising Outreach Events

To raise awareness of climate change and environmental protection, teachers can coordinate with students to organise various awareness-raising events, such as:

- Organising an information day on climate change at school or an open discussion, involving all relevant local educational, scientific and social bodies.
- Organising an exhibition **of 'student creations' that** can be visited by parents and the local community. The products and projects created during the workshops can be exhibited in a specially designed space at the school or in the community and serve as a stimulus for thought and action for students, parents and the local community. In this way, the programme implemented goes beyond the four walls of the classroom and becomes a vehicle for connecting the school with real life.
- Presentation of the event to other classes in the school or to parents, using word processing software and presentations.
- Information/awareness campaign with posters, leaflets with good practices for climate protection, production of radio messages or videos and sending them to a local radio station to raise awareness, writing an article and sending it to the local press.
- Posting of students' work on school notice boards, the school website or in the school newspaper. Communicating with organisations and finally disseminating the learning outcomes throughout the school at a special event to present the programme.
- Presentation of the event to students from other schools

Chapter 3 questions

After completing Chapter 3, participants should be able to give clear and specific answers to questions such as:

- Give three examples of extreme weather events related to climate change.
- Why is today's climate change different from previous natural changes on Earth?
- What are some of the impacts of climate change on health and the economy?
- What is the 'greenhouse effect' and what is the role of carbon dioxide (CO2)?
- Why are humans considered responsible for accelerating climate change?
- Explain why climate change has an impact on human health.
- Give examples of changes in animal biodiversity due to climate change.
- Give examples of changes in plant biodiversity due to climate change.
- In what ways and for what reasons is it useful to involve students and parents in activities to raise awareness about climate protection, and why?
- Suggest at least 5 simple actions that we should all take on a daily basis to protect the environment and contribute, even in a small way, to limiting the effects of climate change.
- Suggest at least 5 simple actions that we should all avoid on a daily basis in order to protect the environment and contribute, even in a small way, to limiting the effects of climate change.

Conclusions of Chapter 3

Climate change -as a complex, human-induced phenomenon- is a key educational field where AI helps to cultivate environmental awareness, interdisciplinary understanding and active participation of citizens, regardless of their age, in environmental protection issues.

Climate change must maintain a "close relationship" with education. Climate change

- **is real and critical**: increasing heat waves, fires, extreme weather events.
- **Historical context**: the climate changes on its own over geological periods. The current change is happening very quickly and **directly affects** life.
- **Greenhouse effect**: Gases such as CO_2/CH_4 trap infrared radiation. Without them, we would have ~-19°C, but **human activity** increases the concentration of these gases in the atmosphere, resulting in a rise in temperature.
- **Human footprint**:
  CO_2 emissions have skyrocketed from megatons to gigatons per year.
- The effects are seen in areas such as health, productivity, agriculture, tourism, and changes in biodiversity.
- Tipping points: AMOC, Greenland/Antarctic ice, Amazon, etc.
- **Greece**: Mediterranean hotspot, intense episodes (e.g. DANIEL), more hot days, heavier rainfall, more fires.
- **Educational Implications**: Teaching based on **scientific data**, analysis of causes/responsibilities, understanding **of fairness/inequalities** in emissions, connection with **policy solutions** (Paris goals, adaptation/mitigation), human activities that affect climate change.

4. Teachers and Education with A I. Ideas and Applications

Objectives of Chapter 4

Upon completion of Chapter 4, the participant will be able to:

- **Explain** how AI affects the educational ecosystem at all levels.
- **Identify** teacher training needs and student digital skill levels.
- **Design** courses that utilise AI in a pedagogically/ethically responsible manner.
- **Organise** student groups and logistical infrastructure for collaborative, multimodal learning.
- **Develop** personalised/differentiated learning plans with AI support.
- **Assess** student work that utilises AI, using criteria of transparency, validity and originality.
- **Link** the cultivation of digital skills/critical thinking with future individual and social well-being.
- **Design** personalised learning programmes with AI for a variety of learning needs.
- **Form** heterogeneous groups of 3–4 students.
- **Define** and **manage** the technical infrastructure (laptops, projection, support material).
- **Define** the roles of the teacher/teams and **cultivate** control over the reliability of sources and the use of AI.
- **Compose** a collective "final learning experience" from individual assignments.
- **Direct** research with clear worksheets and a 4–5 day work schedule.
- **Integrate** source control, documentation and synthesis of opinions into a final presentation.
- **Apply** principles of data protection, avoidance of misinformation, and responsible reporting of AI use.
- **Ensure** human oversight of AI-supported decisions/evaluations.

4.1 Introduction

The emergence of AI in recent years has greatly influenced many human activities and many human groups. It is therefore to be expected that it will influence educational activities at all levels of education and among all educators.

Usually, every change starts at the top and spreads down to the bottom. The usual way to implement an educational innovation is for it to be decided at the highest level, piloted and then implemented across the board, provided that teachers have been properly trained to apply it correctly.

In the specific case of AI, the majority of students know how to use technological applications and AI much earlier and with greater ease than most teachers.

There is an explanation for this. Technological applications and AI appeared in Greece at almost the same time as in other digitally developed countries, mainly due to the widespread use of the internet. Thus, young people became familiar with them before their elders. This necessitated the design and implementation of **"Educational Seminars for Teachers of Various Levels"** by various bodies, so that teachers could:

- Understand the level of digital skills of their students and use it accordingly. In particular, how students use ChatGPT.
- Learn about digital technology applications, especially AI, and how they could best use them in the educational processes they implement in the classroom with their students.
- They should realise that they can use AI by adapting or readjusting the teaching of all subjects without exception, theoretical or practical, and enriching them with exercises, individual or group assignments, graphic representations, relevant images and, in general, innovative educational activities that make the path to knowledge easier.
- They understand that acquiring digital skills for themselves and their students and using AI correctly lays the foundations for critical thinking, enhances educational work, and prepare themselves and their students for their world, a world in which technology will play an increasingly important role in their personal and professional lives.
- Use AI to design personalised lessons for students with high or low IQs, prepare remedial teaching on topics that their students find difficult, approach students' career guidance in an easier way, guide students towards "Entrepreneurship" by presenting them with good practices and innovative ideas for start-ups, businesses, etc.

The European Union recognises education as one of the main sectors where AI can be used and bring very good results at both the individual and social level.

4.2 Teacher Training

The integration of AI into teaching depends on the degree of acceptance by teachers and the degree of training of teachers in the use of AI in the organisation of their lessons and other educational activities.

Teacher training in AI concerns:

- Teaching courses and teaching methodology
- The creation of educational material and the design of general and specific courses
- The organisational structure of the classroom in such a way as to make use of the knowledge, skills and talents of the students
- The way each student is assessed individually
- The development of personalised learning programmes, depending on the specific needs and characteristics of each student.

The introduction of AI can be an un precedented tool for upgrading education, provided it is used correctly.

4.3 Ideas for Organising Courses of General Interest using AI

4.3.1 Preparation Activities

a. Student Distribution
Students are divided into groups of 3 or 4, each group being heterogeneous in terms of gender, performance and friendships, with the aim of working together smoothly and complementing each other.

b. Technical infrastructure.
- Each group should have its own laptop.
- The classroom should have a central computer, printer and video projector for displaying the material.

c. Creation of supporting material related to the topic to be developed by the students and display of this material at key points in the classroom.

d. The roles of the teacher and student groups are defined.
The teacher, in collaboration with the students, plans the activities, encourages the students to use sources of information from relevant literature or the internet, to use AI, choosing the most appropriate IT tools for each case, gather material from reliable sources, check the reliability of their sources and find the most attractive way to present each group's work.

e. The final cognitive experience will result from the **combination of all the teams' work.**

4.3.2 Examples of Classroom Tasks:

Assignment with the following topics
a. Topic. "Theatre and theatrical performance as a means of education and reflection"

The proposed assignment can serve as an example of a suggested lesson and can be applied to students in different grades, provided that the following elements are adapted accordingly:
- The initial introduction by the teacher to their students and
- The preparation of worksheets, which will be given to the students according to the introduction that will precede the assignment

Day 1. -Introduction to the topic by the teacher
- Division of students into groups and appointment of a group leader for each group.
- Distribution to the students in each group of a "worksheet" (WS) related to the topic, such as:

WS 1 The role of theatre in Ancient Greece
WS 2 The role of theatre in modern societies
WS 3 The social and moral messages of Ancient Greek theatre
WS 4 Contemporary theatre performances.

Day 2 and 3 - Each team, using AI and the various "Tools" they have chosen to use (image, sound, video, PowerPoint, etc.), presents its work, which is based on the worksheet it has chosen. Each presentation lasts 10 to 15 minutes.
The team leaders collect copies of the teams' work in electronic form and collaborate with each other on the final presentation of the topic, which will be based on the individual assignments.

Day 4 - The leaders appoint a representative to present the 'Final Project', which is the result of the overall work of all students, to the class. This is followed by discussion, comments and observations. The lesson ends with comments from the teacher (5 minutes).

b. Assignment on the geography of Greece
Topic: "Teaching Geography. Let's get to know Epirus."

The proposed assignment can serve as an example of a suggested lesson and can be applied to students in different grades, provided that the following elements are adapted accordingly:

- The initial introduction by the teacher to their students and
- The preparation of worksheets, which will be given to the students according to the introduction that will precede the assignment.

Day 1 – Introduction to the topic by the teacher.

- Divide the students into groups and appoint a coordinator for each group.
- Distribution of a "Worksheet" (WS) to the students in each group related to the topic, such as:

WS 1 Prepare a map of the region, clearly marking the prefecture's borders, the main cities and areas of particular interest to visitors to the prefecture.
Mark the main mountains with their heights, the rivers from their sources to their mouths, the lakes with their areas, and present any other information you deem necessary, e.g. gorges, bridges, primary and secondary roads.
WS 2 Make a brief record of the history of the Prefecture, from ancient times to the present day. Record the cultural characteristics of the prefecture, such as local dances, songs, costumes, traditional festivals (when and where they take place), traditional recipes, and briefly describe each of them.
WS 3 List the local products of primary and secondary production in Epirus. When are they produced and in what quantities? Which of these are exported outside the prefecture?
WS 4 Note the number of inhabitants of Epirus, their distribution according to age and gender, their distribution by geographical area of the prefecture, and their distribution in the main sectors of employment.
Has there been an increase or decrease in population over the last 20 years? In your

opinion, what is the reason for this change?
WS 5 List the public and private infrastructure in the prefecture, such as

- The number of kindergartens, primary schools, secondary schools, technical schools, universities and the number of students in each category
- The number of hospitals, health centres, ports, fire stations, state and private museums. Monasteries, and comment on the findings.

Day 2 and 3 - Each group, using the AI and the various "Tools" they chose to use (image, sound, video, PowerPoint, etc.), presents its work, which is based on the worksheet it has chosen. Each presentation lasts 10 to 15 minutes.
The team leaders collect copies of the teams' work in electronic form and collaborate with each other on the final presentation of the topic, which will be based on the individual assignments.

Day 4 - The leaders appoint a representative to present the 'Final Project', which is the result of the overall work of all students, to the class.
This is followed by discussion, comments and observations.

Day 5 - The teacher concludes the lesson with a final review, comments on the "Final Project" and the way each group worked, makes observations and comments, and gives praise.

c. Assignment on a topic from Greek history
Topic: "An important historical event: Alexander the Great and his campaign"

The proposed assignment can serve as an example of a suggested lesson and can be applied to students in different grades, provided that the following elements are adapted accordingly:

- The initial introduction by the teacher to their students and
- The preparation of worksheets, which will be given to the students according to the introduction that will precede the assignment

Day 1 – Introduction to the topic by the teacher.
- Divide the students into groups and appoint a coordinator for each group.
- Distribution of a "Worksheet" (WS) related to the topic to the students in each group, such as:

WS 1 Brief description of the historical position of Macedonia in Greece during the 3rd and 4th centuries BC. The royal family, the upbringing and education of Alexander.
WS 2 How Alexander's campaign was organised and implemented. (Movement of troops, transport of supplies, communication with the homeland, etc.)
WS 3 The main battles fought by Alexander's army and when they took place. Alexander's behaviour towards the defeated.
Lessons to be learned from his attitude towards his opponents.
WS 4 Alexander's plans that were not realised due to his untimely death. The end of his campaigns.
WS 5 The reaction of the world over time to the "Alexander" phenomenon and why he was given the epithet "the Great".

Day 2 and 3 - Each group, using the AI and the various "Tools" they have chosen to use (image, sound, video, PowerPoint, etc.), presents its work, which is based on the worksheet it has chosen. Each presentation lasts 10 to 15 minutes.
The team leaders collect copies of the teams' work and collaborate with each other on the final presentation of the topic, which will be based on the individual assignments.

Day 4 - The leaders appoint a representative to present the 'Final Project', which is the result of the overall work of all students, to the class.
This is followed by discussion, comments and observations.

Day 5- The teacher concludes the lesson with a final review and comments on the "Final Project," the way each group worked, makes observations, comments, and gives praise.

d. Assignment on a topic from the Natural Sciences
Topic: "What forms of energy do we know and what is their role in human life and maintaining the balance of the natural environment?"

The proposed assignment can serve as an example of a suggested lesson and can be applied to students in different grades, provided that the following elements are adapted accordingly:

- The initial introduction by the teacher to their students and
- The preparation of worksheets, which will be given to the students according to the introduction that will precede the assignment

Day 1 – Introduction to the topic by the teacher.

- Division of students into groups and appointment of a coordinator for each group
- Distribution of a "Worksheet" (WS) related to the topic to the students in each group, as follows:

WS 1 Define Energy. What forms of Energy do you know? Group the different forms according to their characteristics. Justify the grouping.
WS 2 Describe the role of solar energy reaching the Earth in sustaining life as we know it. What would happen if less or more energy from the Sun reached the Earth?
WS 3 What is the "greenhouse effect", what causes it and how does it affect life on Earth?
WS 4 Describe the positive and negative aspects of energy production from

- Nuclear Power Plants
- Photovoltaic units
- Wind turbines

Day 2 and 3 - Each group, using the AI and the various "Tools" they have chosen to use (images, sound, video, PowerPoint, etc.), presents its work, which is based on the worksheet it has chosen. Each presentation lasts 10 to 15 minutes.
The team leaders collect copies of the teams' work and collaborate with each other on the final presentation of the topic, which will be based on the individual assignments.

Day 4 - The leaders appoint a representative to present the 'Final Project', which is the result of the overall work of all students, to the class.
This is followed by discussion, comments and observations.

Day 5 - The teacher concludes the lesson with a final review, comments on the "Final Project" and the way each group worked, makes observations and comments, and gives praise.

e. Literature assignment

Topic: "Writers and Literature in Greece in the 20th Century"

The proposed assignment can serve as an example of a suggested lesson and can be applied to students in different grades, provided that the following elements are adapted accordingly:

- The initial introduction by the teacher to their students and
- The preparation of worksheets, which will be given to the students according to the introduction that will precede the assignment

Day 1 – Introduction to the topic by the teacher.

- Division of students into groups and appointment of a coordinator for each group
- Distribution of a "Worksheet" (WS) related to the topic to the students in each group, as follows:

WS 1 Prepare a list of the most important Greek writers of the 20th century. Group them according to their particular literary characteristics. Justify the grouping you have made.
WS 2 How much were they influenced in their literary work by the social conditions of their time and their family situation?
How was their work received by readers and how do you think this can be measured? Give some examples.
WS 3 Suggest five works (literary or poetic) that made a particular impression on you. Provide a short excerpt (no more than half a page) from a literary work that impressed you and present it to your classmates. Justify your choice.
In your opinion, can "Writer" and "Literature" become a "profession"? Yes or no, and why.
WS 4 In what form do you prefer to read a book

- Printed
- In electronic form
- As an audiobook Justify your answer

Day 2 and 3 - Each group, using the AI and the various "Tools" it has chosen to use (image, sound, video, PowerPoint, etc.), presents its work, which is based on the worksheet it has chosen. Each presentation lasts 10 to 15 minutes.

The team leaders collect copies of the teams' work and collaborate with each other on the final presentation of the topic, which will be based on the individual assignments.

Day 4 - The leaders appoint a representative to present the 'Final Project', which is the result of the overall work of all students, to the class.
This is followed by discussion, comments and observations.

Day 5 - The teacher concludes the lesson with a final review and comments on the "Final Project", the way each group worked, makes observations, comments and gives praise.

f. Assignment from the Marine Ecosystem Area.
Topic: "The Sea and the Marine Environment. How it Affects Our Lives"

The proposed assignment can serve as an example of a suggested lesson and can be applied to students in different grades, provided that the following elements are adapted accordingly:

- The initial introduction by the teacher to their students and
- The preparation of worksheets, which will be given to the students according to the introduction that will precede the assignment

Day 1 – Introduction to the topic by the teacher.
- Divide the students into groups and appoint a coordinator for each group.
- Distribution of a "Worksheet" (WS) related to the topic to the students in each group, such as:

WS 1 How do you think the sea affects our lives directly and indirectly? List the different ways and areas of influence.
WS 2 Sea pollution. Describe the causes of pollution that you know of and how they affect people and marine flora and fauna.
WS 3 Which marine mammals do you know that can be found in Greek seas?
Classify them according to their size.
Which of these are dangerous to humans and in what way
WS 4 Which human activities threaten marine flora and fauna?
What actions can we take or what actions should we avoid in order to protect the marine ecosystem?
WS 5 What do you know about fish farming? What is your opinion of it?

Day 2 and 3 - Each group, using the AI and the various "Tools" they have chosen to use (images, sound, video, PowerPoint, etc.), presents its work, which is based on the worksheet it has chosen. Each presentation lasts 10 to 15 minutes.

The team leaders collect copies of the teams' work and collaborate with each other on the final presentation of the topic, which will be based on the individual assignments.

Day 4 - The leaders appoint a representative to present the 'Final Project', which is the result of the overall work of all students, to the class.
This is followed by discussion, comments and observations.

Day 5- The teacher concludes the lesson with a final review and comments on the "Final Project," the way each group worked, and offers observations, comments, and praise.

e. Environment-related assignment.
Topic: "What is climate change and how does it affect life on our planet?"

The proposed assignment can serve as an example of a suggested lesson and can be applied to students in different grades, provided that the following elements are adapted accordingly:

- The initial introduction by the teacher to their students and
- The preparation of worksheets, which will be given to the students according to the introduction that will precede the assignment

Day 1 – Introduction to the topic by the teacher.
- Divide the students into groups and appoint a coordinator for each group.
- Distribution of a "Worksheet" (WS) related to the topic to the students in each group, such as:

WS 1 What is climate change and how do we understand it?
WS 2 What negative effects does climate change have on our daily lives? Are there any positive effects and what are they?
WS 3 Can humans influence the effects of climate change?
WS 4 What are the effects of climate change on agriculture, livestock farming and fishing?
WS 5 Does climate change affect the economy of a region or country?

Day 2 and 3 - Each group, using the AI and the various "Tools" they have chosen to use (images, sound, video, PowerPoint, etc.), presents its work, which is based on the worksheet it has chosen. Each presentation lasts 10 to 15 minutes.
The team leaders collect copies of the teams' work and collaborate with each other on the final presentation of the topic, which will be based on the individual assignments.

Day 4 - The leaders appoint a representative to present the 'Final Project', which is the result of the overall work of all students, to the class.
This is followed by discussion, comments and observations.

Day 5- The teacher concludes the lesson with a final review and comments on the "Final Project," the way each group worked, and offers observations, comments, and praise.

g. Environment-related assignment.
Topic: "What do you know about the climate of a region?"

The proposed assignment can serve as an example of a suggested lesson and can be applied to students in different grades, provided that the following elements are adapted accordingly:

- The initial introduction by the teacher to their students and
- The preparation of worksheets, which will be given to the students according to the introduction that will precede the assignment

Day 1 – Introduction to the topic by the teacher.
- Divide the students into groups and appoint a coordinator for each group.
- Distribution of a "Worksheet" (WS) related to the topic to the students in each group, such as:

WS 1 What types of climate are you familiar with? What are their similarities and differences?
WS 2 What is the climate of a region and what factors influence it?
WS 3 Has the climate in different regions of the Earth remained stable throughout history (millennia)? Describe the main differences and their impact on flora and fauna.
WS 4 If you could choose the climate of the region where you live, which would you choose and why?
WS 5 What is microclimate? Can human factors influence it and how?

Day 2 and 3 - Each group, using the AI and the various "Tools" they have chosen to use (image, sound, video, PowerPoint, etc.), presents its work, which is based on the worksheet it has chosen. Each presentation lasts 10 to 15 minutes.
The team leaders collect copies of the teams' work and collaborate with each other on the final presentation of the topic, which will be based on the individual assignments.

Day 4 - The leaders appoint a representative to present the 'Final Project', which is the result of the overall work of all students, to the class.
This is followed by discussion, comments and observations.

Day 5 - The teacher concludes the lesson with a final review and comments on the "Final Project," the way each group worked, and offers observations, comments, and praise.

Chapter 4 Questions

After completing Chapter 4, participants should be able to answer questions such as:

- In which areas should teachers be trained to make the most of AI?
- In what ways can AI improve classroom teaching?
- What skills are developed when teachers and students use AI correctly?
- How can AI help create personalised lessons?
- What does "proper use" of AI in education mean?
- How are students divided into groups for assignments?
- What technical infrastructure is needed to organise courses using AI?
- What is the final stage of each group assignment? And what is the role of teachers?
- How can an assignment such as "Theatre and Theatrical Performance" be used to identify students' particular talents?
    - What is the role of AI?
- How can a project on a geographical area become a reason for students to think about and submit ideas/proposals for the development of a geographical area?
    - What is the role of AI?
- How can an assignment on a historical figure become a means of deepening understanding of the social conditions of the era?
    - What is the role of AI?
- How could you make the most of knowledge about nature, climate and climate change to raise students' awareness of environmental protection issues?

CONCLUSIONS OF CHAPTER 4

AI has already entered education and can substantially upgrade teaching at all levels, **but only if teachers are systematically trained** and use it pedagogically, with an emphasis on critical thinking, personalisation and the reliability of sources.

- Training is not just a technical seminar; it covers:
    - **Teaching methodology** and lesson redesign.
    - **Production/adaptation of material** (scenarios, exercises, images, presentations).
    - **Classroom organisation** that makes the most of talents, roles, and cooperation.
    - **Personalised programmes** (reinforcement, advanced, MDD/EEA).
    - **Ethics – safety – reliability of sources**.

- Educational training objectives:
    - Mapping **digital skills** of (e.g. use ChatGPT).
    - Use of AI **for differentiation** (high/low cognitive level).
    - **Enhancement of critical thinking** and metacognitive skills.
    - **Professional orientation** & **entrepreneurship** (good practices, ideas for start-ups).

AI is not a subject in itself; it is **preparation** for different topics (theatre, geography, history, natural sciences, literature, environment, climate), which must have the following common architecture.

- Common architecture:
  Preparation (groups, roles, infrastructure,worksheets , source rules/AI).
  Interim presentations (10–15') with multimedia & AI tools. **Synthesis** into final assignment (visible learning product). **Reflection**: discussion, comments, evaluation, praise.
- Worksheets lead to **research, criticism, evaluation, creation**—not copying.
- Care is taken to ensure **differentiation** (multiple perspectives/roles) and **interdisciplinarity** (e.g. climate ↔ health ↔ economy).
- AI **does not replace** the teacher; **it strengthens** their role as a learning designer, mentor and quality guarantor.
- Climate change, as **an urgent teaching subject**, shows why we need students with
  research, argumentation, documentation and **collective action** skills.
- School becomes a place where AI is transformed from a "text production tool" into **a catalyst for creativity and critical thinking**, with a tangible social impact.

The responsible integration of AI into education, through targeted training and pedagogical design, upgrades teaching, enhances critical thinking and personalisation, and equips students to face complex challenges - such as the climate crisis - with scientific documentation, collaboration and active citizenship.

Synthetic Assignment – Chapter 4

This assignment relates to the phenomenon of **climate change**, and you are required to use generative artificial intelligence tools (GenAI) to collect information and create new images related to climate change.

More specifically, you should use as primary data sources the documents concerning the New Curricula (NC) issued by the IEP (Institute of Educational Policy) and the corresponding Teachers' Guides (TG).

You will use these data in discussions through questions/prompts with some of the GenAI tools included in the course material.

You may select from the following curricula:
- Preschool Education
- Environmental Studies (Grades A to D of Primary School)
- Active Citizen Education

A total of 6 PDF files, which are freely available at the following link:
https://www.iep.edu.gr/provoli-neon-programmaton-spoudon/

Part A
For 5 images from the Teachers' Guides, use the free versions of **ChatGPT** and **Gemini** (or any other free generative AI tool of your choice, which you must mention). After interacting with the tool (the discussion must be recorded in detail), create a description for each image.

The discussions in both tools should be carried out through your own questions (prompts) and should concern each of the 5 selected images.

You must record the results in detail, per tool and per image.

Indicative (non-binding) prompts are presented in the table below. You may continue the discussion depending on the AI tool's responses.

Table: Indicative "Good" Prompts

1	What does the image (or drawing, diagram, or graph [choose accordingly]) describe?
2	Relate this image (or drawing, diagram, or graph) to climate change.
3	Relate this image (or drawing, diagram, or graph) to the greenhouse effect.
4	Can you give me some ideas for teaching this phenomenon at the chosen education level?
5	Assume you are a 2nd grade student (age), how could the image I uploaded be related to the concept of climate change / the greenhouse effect (gases, etc.) so that a young student can understand it?
6	Combined question: e.g., you found an image with clouds—how would you use this image with 2nd grade students to explain climate change or the greenhouse effect?
7	Your own free, focused question.

Part B

Using two new AI image-generation tools, **Copilot** and **Claude** (or any other free GenAI image-generation tools you choose), create 5 images each (a total of 10 images) corresponding to the images, diagrams, or graphs found in the previous part of the assignment.

You must present the 10 newly generated images.

Part C

Select 5 of the 10 newly generated images and ask any GenAI tool of your choice to explain them using basic climate change terminology.

Record your discussions.

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- New Curricula (PS) and Teacher Guides (OE) of the Institute of Educational Policy (IEP) for Primary School (Primary Education) and Preschool Education.

  1/ Preschool Education (Kindergarten)

  2/ Environmental Studies (1st to 4th grade) 3/ Geography (5th and 6th grade)

  4/ Natural Sciences (5th and 6th grade)

  5/ Active Citizenship (Kindergarten and 1st to 6th grade)

  All of the above PS and OE are freely available on the IEP website (10 pdf files in total): https://iep.edu.gr/el/nea-programmata-spoudon-arxiki-selida https://www2.iep.edu.gr/el/pepragmena-iep-2015-2019
- Artificial Intelligence in Education
  UNESCO: Guidelines for generative artificial intelligence in education and research. Original title: Guidance for generative AI in education...
  https://srv-dide-a.thess.sch.gr/portal2/attachments2/13283/AI%20&%20%CE%95%CE%9A%CE%A0% CE%91%CE%99%CE%94%20final.pdf
- Artificial Intelligence Teaching and Learning
  26 January 2024 - Title: "Artificial Intelligence: Teaching & Learning with AI" - Introductory guide to using AI in education. Author: Alexandros Kofteros. https://www.openbook.gr/techniti-noimosyni-didaskalia-amp-mathisi-me-tn/
- Through tools that facilitate learning for people with special needs, such as speech-to- text software or programmes that
  support language. https://srv- dide-a.thess.sch.gr/portal2/attachments2/13283/AI%20&%20%CE%95%CE%9A%CE%A0%CE%91%CE%99%CE%94%20final.pdf
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  https://www.researchgate.net/publication/380426319_EpharmogesTechnetes_Noe mosynes_gia_ten_yposterixe_tes_symperileptikes_ekpAIdeuses_kAItes_eidikes_ago ges_-_Artificial_Intelligence_applications_for_the_support_of_inclusive_and_education
- This paper explores the views of primary school teachers of general education regarding the inclusion of pupils with special needs. https://dspace.uowm.gr/xmlui/bitstream/handle/123456789/1330/Despoina%20Metsiou.pdf?sequence=1&isAllowed=y

- For the first time, legislation on the education of children with special needs is becoming part of general education legislation, creating in practice.https://pergamos.lib.uoa.gr/uoa/dl/object/2896146/file.pdf
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