



GenAI Booklet

GenAI's theoretical background, educational best practices, societal implications, and hands-on assignments based on GenAI tools

100 mentors



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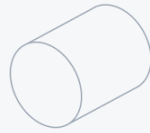
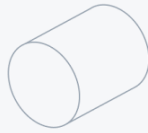


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Chapter 1: Introduction to Generative AI

1.1 What is Generative AI?

Generative Artificial Intelligence (GenAI) has become one of the most influential technologies of the early 21st century. Unlike earlier forms of artificial intelligence, which were typically limited to classifying information, recognizing patterns, or optimizing decisions, generative AI systems are designed to create new content. They can produce text, images, music, computer code, and even multimodal combinations by learning patterns from massive datasets. The defining feature of these systems is their ability to generate outputs that resemble human-made creations (Sharples, 2023). This is why generative AI has captured such wide attention: it is not simply automating existing processes but expanding what machines can produce.



At the core of generative AI are **foundation models**—large models trained on broad datasets, capable of being adapted or prompted to perform a wide variety of tasks. Large Language Models (LLMs), such as GPT-4, are trained to predict the next word in a sequence, allowing them to generate coherent passages of text in response to prompts. In parallel, image generation systems often rely on diffusion models, which create visual outputs by gradually refining patterns of noise into recognizable images. These methods have dramatically lowered the technical barriers to interacting with AI. With only a simple natural-language prompt, users can now access systems that previously required advanced programming or specialist knowledge (Ng et al., 2025).

The **European Commission’s Joint Research Centre (JRC)** frames generative AI as a **general-purpose and disruptive technology**. In its Generative AI Outlook Report, the JRC notes that generative models are “capable of transforming how content is produced and consumed” across domains such as education, science, health, and creative industries (JRC, 2025). By enabling machines to generate new knowledge-like artifacts, GenAI is viewed as a driver of productivity and innovation but also as a potential disruptor of labour markets, communication systems, and cultural practices. The report stresses that because the same models underlie so many applications, regulation and governance need to be coordinated across sectors (JRC, 2025).

Generative AI in Education

The education sector has been one of the fastest to experiment with generative AI. Ng et al. (2025) conducted a large-scale bibliometric analysis of more than 3,800 peer-reviewed journal articles published between 2022 and 2025. They found **exponential growth** in research addressing generative AI in education, confirming that the field has rapidly become central to discussions of teaching, assessment, and learning. Much of this literature focuses on the role of LLMs such as ChatGPT in supporting learning tasks: drafting essays, summarizing content, generating questions, or brainstorming ideas. The authors conclude that generative AI is not peripheral but a mainstream issue in educational discourse (Ng et al., 2025).



Research has also begun to examine how learners perceive and use these tools. In a 2024 study, Matsiola et al. surveyed university students on their use of generative AI for academic purposes. The findings highlight both enthusiasm and caution. Students valued the tools for **ease of use, relevance of outputs, and time-saving potential, but expressed concerns about misinformation, privacy, and the credibility of generated content** (Matsiola et al., 2024). This reflects the dual nature of GenAI: as a helpful support for learning, but also a source of ethical and practical dilemmas.

From a pedagogical standpoint, Sharples (2023) argues for understanding generative AI as a **social partner in learning**. Instead of framing it as a static tool that produces answers, he describes it as part of a conversation. In this view, students learn best when they interact iteratively with GenAI systems—exploring, questioning, and refining ideas. Generative AI becomes not just an answer engine but a collaborator in inquiry, enabling learners to test hypotheses, model scenarios, or generate creative outputs. This perspective emphasizes the importance of critical engagement rather than passive consumption.

Generative AI in Public Administration and Policy

Generative AI is also emerging in governance and administration. A JRC research brief, *The Potential of Generative AI for the Public Sector*, surveyed European public managers and found that nearly one-third were already using generative AI in their work, while 44% planned to integrate it in the near future (Tangi et al., 2024). The brief identified about 60 concrete use cases across European administrations, from automated drafting of policy documents to enhanced citizen communication. It also highlighted the policy questions these deployments raise: how to ensure accuracy, prevent bias, and safeguard sensitive data.

The JRC has even studied its own internal adoption. De Longueville et al. (2025) report on the introduction of GPT@JRC, an internal platform that gave 10,000 knowledge workers access to generative AI tools. Staff used the system for summarizing reports, drafting texts, and generating new ideas. While the pilot

confirmed significant productivity benefits, it also revealed challenges: the need for clear guidelines, training for responsible use, and governance mechanisms to handle sensitive or confidential material (De Longueville et al., 2025).

These experiences reflect broader policy debates. As the JRC (2025) notes, generative AI sits at the intersection of multiple European legal frameworks, including the forthcoming AI Act, the General Data Protection Regulation (GDPR), and data governance rules. Policymakers must adapt existing instruments while developing new rules for generative models specifically. Because these technologies cut across sectors, regulation cannot be confined to one area; instead, coordinated governance is necessary.

Opportunities and Risks

The opportunities of generative AI are broad. It can **democratize creativity**, allowing users without formal artistic or writing training to produce sophisticated content. In education, it offers the possibility of personalized feedback and differentiated instruction. In science and policy, it can accelerate knowledge work by summarizing literature or generating draft documents (Ng et al., 2025; De Longueville et al., 2025). The JRC (2025) also highlights the potential of GenAI to foster innovation in creative industries and improve accessibility, for instance by generating alternative formats for content.

At the same time, the risks are significant. The JRC report warns of **misinformation and disinformation**, as generative models can easily produce realistic but false content. Biases embedded in training data can be replicated or amplified. Labour markets may face disruption as routine creative or cognitive tasks are automated. Privacy is also a concern: users risk sharing sensitive data when interacting with GenAI platforms (JRC, 2025). In education, there is the risk of over-reliance, where students might bypass critical thinking by letting AI complete assignments (Matsiola et al., 2024).

These tensions make governance critical. Europe's approach is to place generative AI within a **human-centric, rights-based framework**. Instead of treating it as a purely technical challenge, policymakers emphasize values such as transparency, accountability, and fairness. Users should be informed when

they interact with AI-generated content, developers should ensure data quality and mitigate bias, and oversight should protect fundamental rights. In this sense, generative AI is both a technological and a societal issue.

A Sociotechnical Shift

Overall, generative AI should not be understood simply as another tool, but as part of a **sociotechnical system** that includes humans, institutions, data, and governance. It reshapes the relationship between people and machines, positioning AI as a co-creator. For young people, particularly Generation Z, who are already immersed in these tools, the challenge is to develop not only technical fluency but also critical literacy: the ability to question, evaluate, and use generative AI responsibly. This aligns with European priorities around digital readiness, inclusion, and ethical innovation.

As Sharples (2023) notes, the task ahead is to design practices that encourage **collaboration between humans and AI**, rather than replacement. In this way, generative AI can be harnessed to enhance creativity, productivity, and learning, while society collectively manages its risks. Europe's policy framework, backed by research evidence, is moving in this direction: treating GenAI not as an inevitability to accept uncritically, but as a powerful technology to shape responsibly.

1.2 Evolution of AI and the Rise of Generative AI

Artificial Intelligence (AI) has a history stretching back over seven decades. While the concept of “thinking machines” can be traced to earlier philosophical debates, the modern field was formalized in the 1950s, with the Dartmouth Conference of 1956 often considered its symbolic starting point. Over the decades, AI has evolved through distinct phases—each marked by advances in methods, computing power, and societal expectations. The rise of **generative AI** is the most recent phase in this story, representing both a continuation of long-term progress and a radical transformation in what AI can achieve.

Early Symbolic AI and Expert Systems

In its earliest decades, AI was dominated by **symbolic approaches**. Researchers sought to encode human knowledge directly into rules and symbols that computers could manipulate. These systems were capable of solving logic puzzles, playing games like chess, or simulating simple decision-making processes. However, their limitations soon became apparent. Symbolic AI required precise rules and could not easily handle uncertainty or ambiguity. Despite early optimism, progress slowed during the so-called “**AI winters**” of the 1970s and late 1980s, when funding and interest diminished due to unmet expectations (Delipetrev, Tsinaraki, & Kostic, 2020).

One major achievement of the symbolic era was the rise of **expert systems** in the 1980s. These systems attempted to codify the expertise of human professionals into decision-making software. They were widely applied in domains like medical diagnosis, engineering, and business management. Yet expert systems required enormous effort to maintain and update, and they lacked the flexibility to adapt to new information. Their eventual decline paved the way for data-driven approaches that would dominate AI in the decades to come.

The Machine Learning Revolution

By the 1990s, researchers shifted focus from rule-based systems to **machine learning** (ML)—algorithms that could learn patterns from data rather than relying on manually coded rules. With increasing availability of digital data and improvements in computing hardware, ML approaches like decision trees, support vector machines, and clustering methods became popular. These methods demonstrated practical results in areas like fraud detection, speech recognition, and recommendation systems.

The true breakthrough came with the resurgence of **artificial neural networks (ANNs)**. Inspired loosely by the structure of the brain, ANNs could process large amounts of data through interconnected layers of artificial neurons. While neural networks were proposed as early as the 1950s, they only became practical in the 2000s when computing power (especially GPUs) caught up with the computational demands. By the mid-2010s, deep neural networks achieved



state-of-the-art results in image recognition, natural language processing, and other complex tasks, sparking what many call the **deep learning revolution** (Cocho-Bermejo, 2025).

The Rise of Deep Learning

Deep learning refers to the use of neural networks with many layers—often millions or billions of parameters—that can capture highly complex relationships in data. A famous milestone was achieved in 2012 when a deep neural network developed by researchers at the University of Toronto dramatically outperformed competitors in the ImageNet visual recognition competition. This marked the beginning of widespread adoption of deep learning across industries.

The 2010s saw rapid advances in speech recognition (driving the success of voice assistants like Siri and Alexa), machine translation (Google Translate), and computer vision (autonomous vehicles, medical imaging). The ability of deep learning models to generalize from vast datasets enabled new applications in science, industry, and entertainment.

From Deep Learning to Generative Models

While most early deep learning systems were **discriminative**—focused on classification or prediction—researchers also pursued **generative models**, capable of producing new data resembling the training examples. Early approaches like variational autoencoders (VAEs) and generative adversarial networks (GANs) demonstrated the possibility of synthesizing realistic images, voices, or text. GANs in particular, introduced in 2014, became famous for producing photorealistic faces of people who do not exist.

The transformative step came with the advent of **transformer architectures** in 2017. Originally developed for language tasks, transformers enabled models to process sequential data more efficiently and capture long-range dependencies in text. This architecture underpins today's large language models. Transformer-based systems such as BERT, GPT, and T5 revolutionized natural language



processing by producing coherent, context-aware text and enabling flexible transfer across tasks (Coccia, 2025).

Foundation Models and Large Language Models

The term **foundation models** emerged to describe very large models trained on general-purpose data, which could then be adapted to many downstream tasks. These models represent a paradigm shift: rather than building bespoke AI systems for each application, researchers train one large model and fine-tune it for multiple purposes. OpenAI's GPT series, culminating in GPT-4, is one prominent example. Google's PaLM and Meta's LLaMA are others.

These models are capable of performing diverse tasks—translation, summarization, reasoning, and dialogue—without explicit task-specific programming. Their outputs are generated through simple prompting in natural language, making them accessible to non-specialists. This accessibility has been a key factor in the rapid diffusion of generative AI into mainstream use (Williams, Hatfield, & Rawal, 2025).

Diffusion Models and Multimodality

Alongside text generation, image generation has advanced through **diffusion models**. These models generate images by starting with random noise and iteratively refining it into a structured output guided by a text description. Tools like DALL·E, MidJourney, and Stable Diffusion are based on this approach. Diffusion models have extended to video, 3D models, and even music, underscoring the multimodal potential of generative AI (Kılınç & Keçecioğlu, 2024).

The integration of modalities—text, image, audio—into unified models is the next frontier. Multimodal systems can generate captions for images, create images from text, or even provide explanations across modalities. This trend represents a move toward more general artificial intelligence systems.

The European Context

In Europe, the rise of generative AI is framed not only as a technological development but as part of a **policy and governance challenge**. The EU has



monitored AI evolution through initiatives like AI Watch, which provides historical and technical assessments of AI progress (Delipetrev et al., 2020). The forthcoming AI Act classifies systems according to risk and explicitly addresses generative models, recognizing their dual potential for innovation and harm (Trigka & Dritsas, 2025).

The European approach emphasizes a **human-centric model** of AI: fostering innovation while ensuring transparency, accountability, and alignment with fundamental rights. This reflects a broader European tradition of embedding technological progress within ethical and social frameworks. By doing so, the EU aims to harness the benefits of generative AI while avoiding the pitfalls of unchecked deployment.

Conclusion: A New Phase in the AI Journey

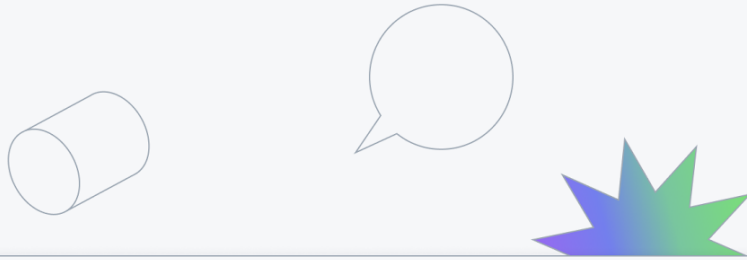
Looking back, the evolution of AI can be seen as a series of waves: symbolic systems, expert systems, machine learning, deep learning, and now generative AI. Each wave built upon the last, but generative AI is unique in its capacity to produce new knowledge-like artifacts and to engage users in natural, conversational ways. It is both the product of decades of research and a new frontier that redefines how humans interact with machines.

As Europe and the world adapt to this shift, the lessons of history are crucial. Past “AI winters” remind us of the risks of hype and over-expectation. At the same time, the rapid progress of the past decade shows the transformative power of sustained research, infrastructure, and governance. Generative AI is not the end of AI’s story, but the beginning of a new phase—one that blends creativity, computation, and human values in unprecedented ways.

1.3 Why Generative AI Matters for Generation Z

Generation Z—broadly defined as those born between the mid-1990s and early 2010s—are the first true “digital natives.” They grew up with broadband internet, smartphones, and social media as ubiquitous features of daily life. This constant connectivity has shaped their expectations: rapid access to information, intuitive interfaces, and on-demand creativity. It also explains why Gen Z has





embraced generative AI (GenAI) with remarkable speed. For this generation, the ability to collaborate with machines that generate text, images, or code is not only natural, but an extension of the digital tools they already use.

Adoption and Interest

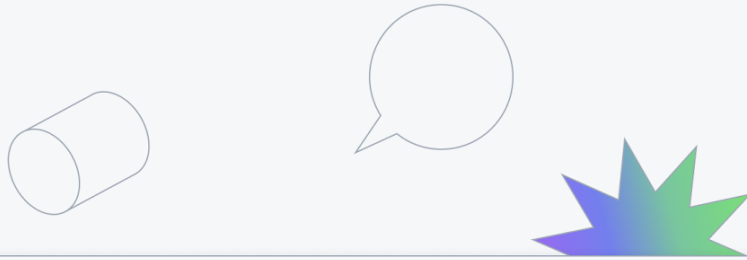
Several studies confirm that Gen Z is at the forefront of generative AI adoption. Chan and Lee (2023) found that Gen Z students are significantly more inclined than older cohorts (Gen X and Millennials) to experiment with tools like ChatGPT in their learning. They characterized this generation as entrepreneurial and adaptable, open to technological disruption, and motivated by problem-solving and creativity. Ali et al. (2024) similarly describe how Gen Z learners adopt GenAI as a “future-shaping technology,” integrating it into their academic and creative practices almost instinctively.

Across Europe, survey data and institutional reviews show comparable trends. Granić (2025) highlights that younger cohorts display higher acceptance of AI in education compared to older users, though adoption patterns vary by region. In Albania, Poland, and Serbia, for example, Gen Z students demonstrated both high enthusiasm and strong concerns about trust in generative AI systems, emphasizing the need for transparency (Pomianek, Muća, & Paraušić, 2025).

Skills and Competencies

The significance of generative AI for Gen Z lies in how it intersects with the **skills and competencies** this generation needs for the future. Toma and Hudea (2024) show that Gen Z students increasingly perceive competencies such as digital literacy, adaptability, and critical thinking as essential in the age of AI. Generative AI not only requires these skills but also provides a platform to develop them further. Using an AI system critically demands understanding its limitations, evaluating its outputs, and integrating them responsibly into one’s own work.

In higher education, studies emphasize that generative AI can empower students by providing scaffolding, enhancing research efficiency, and supporting creativity. Hromada (2024) documents how AI assists Gen Z learners



in navigating higher education challenges, from producing study materials to managing information overload. However, this potential is realized only if students cultivate complementary human skills—such as judgment, collaboration, and ethical awareness—that AI cannot replicate.

Opportunities for Learning and Creativity

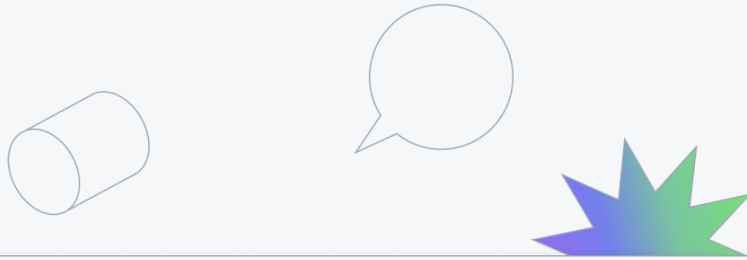
Generative AI aligns closely with Gen Z’s values of **self-expression, creativity, and personalization**. Tools like DALL·E or Stable Diffusion allow them to produce high-quality visual art without advanced training, while ChatGPT can help brainstorm or outline essays. This capacity to create “on demand” appeals to a generation accustomed to fast, interactive media.

In education, GenAI can provide tailored support, generating explanations at the appropriate level, offering multiple perspectives on a topic, or simulating conversational practice in foreign languages (Jin et al., 2025). Such personalization enhances engagement and can help students feel more in control of their learning. At the same time, GenAI supports collaborative creativity: students can co-design prompts, share outputs, and refine ideas collectively, turning AI use into a social practice.

Employability and Future Skills

Employability is another reason generative AI matters deeply to Gen Z. As Minguez Orozco and Welin (2024) note, organizations across Europe are already investing heavily in generative AI. Young professionals entering the workforce will be expected to use these tools effectively, just as earlier generations were expected to master office software or digital communication. The ability to collaborate with AI systems will become part of baseline professional competence.

Moreover, Gen Z faces labour market uncertainties shaped by automation and technological disruption. While some worry about job displacement, GenAI also opens pathways for new kinds of work, especially in creative industries, digital marketing, software development, and data-driven fields. By learning to use



GenAI critically and productively, Gen Z can position themselves not as victims of automation but as leaders in its deployment.

Challenges and Risks

Despite these opportunities, generative AI also poses risks for Generation Z. Studies consistently highlight concerns about **trust, accuracy, and ethics**. Pomianek et al. (2025) found that even in regions with high adoption, Gen Z students emphasize skepticism about whether AI outputs are credible. Matsiola et al. (2024) similarly report that students worry about privacy, misinformation, and plagiarism when using AI in academic contexts.

Another challenge lies in **over-reliance**. If students use AI primarily as a shortcut to complete assignments, they may weaken their critical thinking or creativity. Chubareva (2023) cautions that many Gen Z learners expect AI to provide immediate answers but often underestimate the importance of soft skills such as communication and teamwork, which remain crucial for employability. The COVID-19 pandemic further amplified these soft skill gaps, highlighting the need for balanced skill development in the AI era.

The European Youth Perspective

European institutions are increasingly aware that the rise of generative AI intersects with youth development. Reports such as *Generative AI and Higher Education: Challenges and Opportunities* emphasize that adoption must be strategic, with policies ensuring that students benefit without compromising academic integrity (Hoernig et al., 2024). Similarly, the EU's **Digital Education Action Plan** stresses digital literacy, resilience, and ethical AI use as core competences for young people.

Generative AI can therefore be seen as both a challenge and a catalyst for educational reform. Jin et al. (2025) highlight that universities worldwide are creating institutional guidelines for GenAI adoption, balancing innovation with integrity. In Europe, this movement dovetails with Erasmus+ priorities around digital readiness and inclusion, ensuring that youth are equipped to thrive in an AI-rich society.



For Generation Z, generative AI is not just another technological novelty. It is a defining feature of their educational experience, a critical tool for employability, and a medium for creativity and self-expression. Gen Z's embrace of GenAI reflects their adaptability and digital fluency, but also underscores the need for critical thinking, ethical awareness, and resilience. In Europe, where youth policies emphasize inclusion and responsible innovation, generative AI can serve as a vehicle to empower young people—provided its risks are managed with care. Ultimately, why GenAI matters for Generation Z is not only because they use it, but because they are the generation that will shape how society integrates it.

1.4 The Role of Generative AI in Erasmus+ and Lifelong Learning

Lifelong learning has long been a central ambition of European education policy. It refers to the continuous process of acquiring knowledge and skills throughout life, not only in formal educational institutions but also through informal and non-formal contexts. In a rapidly changing technological landscape, lifelong learning is essential for individuals to remain adaptable, employable, and engaged citizens. The rise of **generative AI (GenAI)** adds new dimensions to this vision, offering tools that can both support and challenge adult learning.

Generative AI and Lifelong Learning

Generative AI has the potential to act as a powerful facilitator of lifelong learning. Unlike static resources, GenAI systems can create dynamic, personalized learning materials tailored to the learner's background, pace, and goals. Tomaszewska (2023), in a study exploring ChatGPT in adult education, highlights that GenAI can function as a conversational tutor, providing explanations, examples, and practice opportunities adapted to the learner's context. This aligns well with **andragogy**, the theory of adult learning, which emphasizes autonomy, self-direction, and relevance.

One important feature of lifelong learning is its inclusivity: it serves diverse groups, from professionals seeking reskilling to older adults pursuing personal

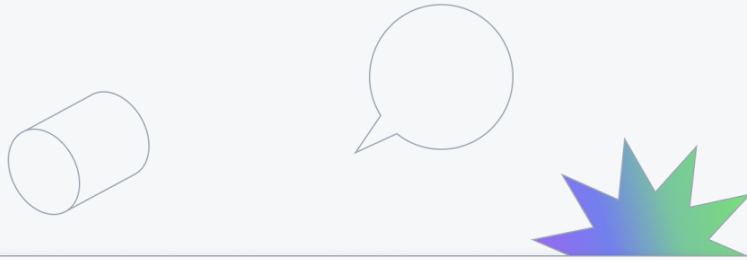
enrichment. Spulber, Amoretti, and Siri (2024) emphasize that AI tools can support learning for older generations by promoting **cognitive health and digital inclusion**. Their study, linked to EU projects on education in the “third age,” shows that AI-enabled platforms can empower seniors to engage with digital content and maintain mental agility, which is a critical component of active ageing.

Generative AI also offers practical advantages for adult learners who often face time constraints. With limited availability to attend structured courses, adults can rely on AI-driven tools to generate summaries, practice questions, or even project-based learning scenarios on demand. Carmo (2025) points out that GenAI fosters teamwork and problem-solving in adult education settings, enabling collaborative learning even when participants are dispersed geographically.

Skills for a Changing Workforce

The role of lifelong learning is particularly significant in the context of the labour market. As automation reshapes industries, adults must continuously update their skills to remain competitive. Generative AI contributes by enabling **microlearning** and **just-in-time training**. Learners can interact with AI to gain immediate insights, simulate workplace tasks, or practice communication skills. According to Hoernig et al. (2024), integrating GenAI into higher education and professional training creates opportunities for workers to adapt faster to evolving demands while maintaining high-quality standards.

Mazohl, Yeratziotis, and Tsouris (2024), in the context of an Erasmus+-supported project (The DigiComPass Training Course), describe how flipped classrooms combined with AI-assisted content creation provide learners with greater flexibility. This model illustrates how generative AI can underpin lifelong learning by giving learners ownership of their pace while teachers shift to guiding and mentoring roles. The approach also highlights how lifelong learning strategies can integrate AI without diminishing the human dimension of education.



Ethical and Pedagogical Challenges

Despite its potential, integrating generative AI into lifelong learning is not without challenges. Tomaszewska (2023) cautions that reliance on conversational AI in adult education requires careful consideration of **accuracy and trustworthiness**. Adult learners often seek reliable and practical knowledge for immediate application, and flawed or biased outputs can undermine their learning experience. Furthermore, educators must guard against over-reliance, ensuring learners maintain critical thinking and reflective capacities.

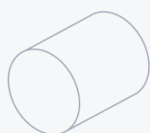
Hoernig et al. (2024) also stress the importance of institutional frameworks. Without clear guidelines, both learners and educators may face uncertainty about how to use GenAI responsibly. This is particularly relevant in professional training, where misuse could have direct workplace consequences. Policies must therefore balance innovation with safeguards, ensuring AI use complements, rather than replaces, human learning processes.

Erasmus+ and the European Dimension

While the broader focus is lifelong learning, it is important to recognize how **Erasmus+** contributes to shaping AI adoption. As the EU's flagship programme for education, training, youth, and sport, Erasmus+ supports projects that integrate digital transformation and promote innovative pedagogical practices. Araújo and Palmeirão (2023) note that Erasmus+ initiatives encourage pedagogical innovation and cross-border collaboration, creating fertile ground for experimenting with new learning technologies, including AI. Recent Erasmus+ projects, such as DigiComPass (Mazohl et al., 2024), explicitly explore AI-supported lifelong learning models, embedding generative AI into curricula to strengthen digital skills.

Generative AI is reshaping lifelong learning by making it more **flexible, personalized, and inclusive**. It supports self-directed adult learners, empowers older generations to remain digitally active, and equips professionals with adaptable skills for changing labour markets. However, its integration requires careful attention to ethical concerns, institutional support, and the cultivation of critical thinking. Erasmus+, as part of Europe's strategy, provides an essential





framework for piloting and scaling such innovations across borders. Together, lifelong learning and generative AI offer a pathway toward a future where education is continuous, accessible, and responsive to the needs of all generations.



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Chapter 2: Theoretical Framework

2.1 Foundations of Artificial Intelligence

Artificial Intelligence (AI) is often described as one of the most transformative technologies of our time, but its foundations rest on decades of research in computer science, mathematics, logic, and cognitive science. Understanding these foundations is critical for making sense of how AI systems—including generative AI—function, their limitations, and their implications for society. This section outlines the main concepts underpinning AI, the distinction between different types of AI, the role of machine learning, and the European perspective on how these foundations shape policy and innovation.

Defining Artificial Intelligence

There is no single universally accepted definition of AI, but most converge on the idea of machines performing tasks that normally require human intelligence. Stuart Russell and Peter Norvig’s well-known textbook frames AI as the science and engineering of making intelligent machines capable of perceiving, reasoning, learning, and acting (Russell & Norvig, 2010). At a policy level, the European Commission defines AI systems as software that, for a given set of human-defined objectives, can generate outputs such as predictions, recommendations, or content that influence the environments they interact with (Früh & Haux, 2022).

This dual perspective—technical and policy-oriented—illustrates how AI straddles both scientific theory and societal governance. While engineers view AI as a set of algorithms, policymakers emphasize its impact on decision-making, autonomy, and trust.

Types of AI: Narrow, General, and Strong

AI can be categorized in several ways. A common distinction is between **Narrow AI (ANI)**, **General AI (AGI)**, and **Strong/Supersuperintelligent AI**.



- **Narrow AI** describes systems designed for specific tasks, such as facial recognition, spam detection, or machine translation. Most AI in use today falls into this category.
- **General AI** refers to systems capable of performing a wide range of intellectual tasks, with the flexibility and adaptability of human intelligence.
- **Strong AI** is a more speculative concept, implying consciousness or self-awareness. While it remains a subject of philosophical debate, it raises questions about ethics, rights, and human identity.

Current advances, including large language models and generative systems, remain forms of **narrow AI**: they are powerful in specific domains but lack human-level general reasoning (Taulli, 2019). Yet their versatility—being able to generate text, images, or code—has renewed debates about whether we are moving closer to AGI.

Core Components of AI

AI systems rely on several foundational components:

1. **Data** – AI depends on access to large, structured or unstructured datasets. Data quality, diversity, and representation are crucial because biased or incomplete data can lead to biased outputs (Kühl et al., 2022).
2. **Algorithms** – Algorithms are sets of instructions that guide how data is processed. In AI, they range from decision trees to deep neural networks. Algorithms determine how machines learn, reason, and act.
3. **Models** – Trained algorithms produce models: mathematical representations of relationships in data. Models can then be applied to new data for prediction, classification, or generation.
4. **Feedback** – Learning often requires feedback loops. In supervised learning, models are trained with labeled data; in reinforcement learning, they adjust actions based on rewards and penalties (Rius, 2023).
5. **Hardware and Infrastructure** – AI requires significant computing power, including GPUs and cloud infrastructures, which enable large-scale training and deployment.

These components interact to create systems capable of performing tasks ranging from simple pattern recognition to sophisticated conversational interaction.

Machine Learning as the Basis of AI

Although AI encompasses many approaches, **machine learning (ML)** has become its dominant paradigm. ML refers to algorithms that improve their performance at a task through experience (data) without explicit programming. Early AI relied on symbolic reasoning and rules; modern AI thrives on statistical methods that allow computers to “learn” from examples.

Machine learning can be classified into:

- **Supervised learning** – models learn from labeled examples (e.g., predicting housing prices from past data).
- **Unsupervised learning** – models identify patterns or clusters in unlabeled data (e.g., customer segmentation).
- **Reinforcement learning** – agents learn by interacting with environments and receiving feedback (e.g., training an AI to play chess).

Deep learning, a subset of ML, uses multi-layer neural networks to capture highly complex patterns, powering breakthroughs in speech recognition, computer vision, and natural language processing (Marwala, 2018). These techniques underpin generative AI as well, demonstrating the continuity between traditional AI foundations and today’s innovations.

Knowledge Representation and Reasoning

Beyond machine learning, a foundational area of AI is **knowledge representation and reasoning (KRR)**. This branch seeks to formalize how knowledge can be encoded in machines, enabling them to draw logical inferences. Approaches include semantic networks, ontologies, and rule-based systems. While less visible than machine learning, KRR remains vital for explainability and transparency—particularly in European contexts where policy requires that AI systems provide understandable reasoning for their outputs (Annoni et al., 2018).



The European Perspective

Europe has emphasized that AI foundations must be understood not only scientifically but also normatively. The European Commission's AI Watch initiative traces the historical and technical foundations of AI to inform policymaking (Delipetrev, Tsinaraki, & Kostic, 2020). The AI Act builds on this by classifying systems based on risk, with requirements for transparency, accountability, and human oversight.

Europe's framing of AI emphasizes:

- **Human-centric values** – AI should enhance human welfare rather than replace it.
- **Ethical safeguards** – Fundamental rights, fairness, and non-discrimination must be protected.
- **Trust and transparency** – Users must understand how AI reaches conclusions, particularly in high-stakes areas like healthcare and justice.

This perspective distinguishes Europe from more laissez-faire approaches elsewhere, positioning the EU as a leader in **responsible AI governance**.

Challenges in the Foundations of AI

Despite remarkable progress, the foundations of AI present challenges:

- **Bias and fairness** – Models reproduce biases from training data, leading to unequal outcomes.
- **Explainability** – Deep learning systems often function as “black boxes,” making it difficult to interpret their decisions.
- **Data governance** – Access to high-quality, representative datasets raises privacy and security concerns.
- **Resource intensity** – Training large models requires massive energy and computing power, raising sustainability issues.

These challenges are not peripheral but central to how AI is designed, deployed, and governed. They also underscore why Europe integrates AI foundations with legal and ethical frameworks.



The foundations of AI combine **scientific principles, technical architectures, and social considerations**. From definitions and types of AI to the roles of data, algorithms, and reasoning, these elements form the basis for modern systems—including generative AI. While narrow AI dominates today’s applications, debates about AGI reflect the ongoing tension between ambition and reality. Europe’s insistence on human-centric, trustworthy AI demonstrates how foundations are not merely technical but also deeply political.

As learners, educators, and policymakers engage with generative AI, returning to these foundations provides clarity: AI is not magic but a set of methods, shaped by human choices, capable of both great promise and significant risk. Understanding its building blocks is the first step toward using it responsibly and effectively in society.

2.2 How Generative AI Works

Behind this apparent “magic” of AI, lie well-established computational methods. Two of the most important are **Large Language Models (LLMs)**, which generate text, and **diffusion models**, which generate images and other visual content. Understanding these systems helps learners demystify AI and engage with it critically, rather than treating it as a black box.

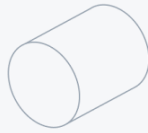
Large Language Models (LLMs): Predicting the Next Word

At the heart of LLMs is a simple principle: predicting the next word in a sequence. Given a text like “The cat sat on the...”, an LLM calculates which word is most likely to follow. If trained on massive amounts of text, the model learns patterns of grammar, style, and meaning so well that it can generate coherent paragraphs, essays, or even code.

How They Work

1. **Tokenization:** Text is broken into units (words or subwords).
2. **Embeddings:** Each token is converted into a vector (a list of numbers) that represents its meaning in context.
3. **Transformer Architecture:** Modern LLMs use transformers, a neural network architecture introduced in 2017. Transformers rely on a





mechanism called **attention**, which allows the model to weigh the importance of different words relative to each other. For example, in the sentence “The cat chased the mouse because it was hungry,” attention helps the model figure out that “it” refers to the cat.

4. **Training:** The model is trained on a vast corpora of text—books, articles, websites—using billions of parameters (weights that adjust during training). The training goal is to minimize the error in predicting the next token.
5. **Generation:** At use time, the model outputs the most probable next token. With randomness (temperature settings) added, it can produce diverse and creative responses.

Why They Seem So Human

LLMs don’t “understand” language in the human sense. They don’t have intentions or consciousness. Instead, they are statistical engines that generate likely continuations of text. However, because they have seen so much data, the outputs often appear thoughtful, even creative. For instance, an LLM can write a poem about climate change in the style of Shakespeare, not because it understands climate or poetry, but because it has absorbed patterns from countless texts.

Diffusion Models: Creating Images from Noise

While LLMs generate text, **diffusion models** create images by starting with random noise and gradually transforming it into a coherent picture. Imagine beginning with “static” on a television screen and slowly revealing a landscape or portrait. That is essentially how diffusion works.

This happens through a:

1. **Forward Process:** During training, real images are gradually “noised”—random noise is added step by step until the image becomes indistinguishable static. The model learns this process of destruction.



2. **Reverse Process:** The core innovation is teaching the model to reverse the process: starting with noise and progressively removing it, step by step, until a plausible image emerges.
3. **Guidance by Prompts:** Text-to-image diffusion models, like DALL-E or Stable Diffusion, add another element: prompts. The model learns to associate patterns of words with patterns in images. For example, the phrase “a dog playing violin” activates visual features that shape how noise resolves into an image.
4. **Sampling:** By sampling multiple times, diffusion models can produce many different outputs for the same prompt, each variation reflecting different learned probabilities.

Why They Are Powerful

Diffusion models generate remarkably detailed and realistic images because the step-by-step process allows fine-grained control of textures, colors, and shapes. Unlike earlier models (e.g., GANs), diffusion models are more stable and less prone to producing distorted outputs.

Comparing the Two Approaches

Feature	Large Language Models (LLMs)	Diffusion Models
Domain	Text, code, dialogue	Images, video, audio
Mechanism	Next-word prediction using transformers	Step-by-step noise removal
Training Data	Text corpora (books, articles, internet)	Image-text pairs, large image datasets
Output	Sentences, essays, chat, summaries	Photorealistic or artistic visuals
Examples	GPT-4, Claude, LLaMA	DALL-E, MidJourney, Stable Diffusion

Both systems are probabilistic: they generate new content by sampling from patterns learned during training, not by memorizing exact examples. This

explains why they can produce novel creations, but also why they sometimes generate mistakes (“hallucinations” in text, unrealistic details in images).

Everyday Examples

- **LLMs:** A student asks ChatGPT to “explain photosynthesis in simple words.” The model predicts words one by one, drawing from patterns across millions of biology texts, until it produces a clear explanation.
- **Diffusion Models:** A designer types “a futuristic city built on clouds” into Stable Diffusion. The model starts from random pixels and refines them over dozens of steps, ending with a fantastical image.

Knowing how LLMs and diffusion models work is crucial for several reasons:

1. **Critical Thinking:** Users recognize that outputs are not objective truths but probabilities. This encourages checking facts and avoiding blind trust.
2. **Ethical Awareness:** Understanding training data helps identify potential biases (e.g., underrepresentation of certain cultures in image datasets).
3. **Practical Skills:** By knowing how prompts guide outputs, users can design better inputs—this is the basis of **prompt engineering** (covered in Section 2.3).
4. **Transparency:** Policymakers stress explainability: users should grasp not every technical detail, but the broad principles of how AI generates results.

2.3 Prompt Engineering as a Core Skill

Generative AI tools rely on one central mechanism: the **prompt**. Whether users are writing text with ChatGPT, generating visuals with DALL·E, or creating presentations with Gamma, the output depends heavily on the quality of the input. As the literature on GenAI emphasizes, “communication with ChatGPT involves creating prompts, i.e., specially constructed queries. The quality of the response depends on the quality of the prompt”. This has given rise to **prompt engineering**—the practice of crafting effective inputs to guide AI models toward more useful, accurate, and creative outputs.



In an educational context, prompt engineering is more than a technical skill; it is a form of digital literacy. By learning how to design prompts effectively, students, educators, and professionals can better harness AI's capabilities while avoiding over-reliance on generic, low-quality responses.

What is a Prompt?

A **prompt** is any text or instruction given to an AI model to generate a response. In natural language, this can be as simple as a question—"What is photosynthesis?"—or as complex as a multi-part instruction: "Explain photosynthesis to high school students in three paragraphs, using analogies, and include one simple diagram."

Prompts function as **interfaces** between human intention and machine output. The more clearly the human expresses the task, context, and expected format, the more likely the AI is to provide a useful answer. This is why prompt engineering is emerging as a vital skill across industries, from education and journalism to programming and design.

Structures of Effective Prompts

Strong prompts often include **four structural elements**:

1. **Role** – Assigning the AI a role helps frame the response. Example: "*You are an experienced biology teacher...*".
2. **Task** – Clearly state what the AI should do. Example: "*...explain the process of photosynthesis...*".
3. **Context** – Provide background details to guide tone, style, or depth. Example: "*...for a group of high school students with no prior biology knowledge...*".
4. **Output Format** – Indicate the desired structure of the answer. Example: "*...in three short paragraphs, each with a heading, plus a list of key terms at the end.*"

Combining these elements transforms a vague request into a precise instruction. This reflects findings in AI pedagogy research: **specific prompts**



reduce irrelevant outputs and encourage higher-quality responses (Batista, Mesquita, & Carnaz, 2024).

Weak vs. Strong Prompts: Examples

- **Weak Prompt:** “Tell me about photosynthesis.”
 - *Problem:* Too broad; no guidance on audience, length, or style.
 - *Likely Output:* A generic, textbook-like definition.
- **Strong Prompt:** “You are a high school biology teacher. Explain photosynthesis in three short paragraphs, using a metaphor that compares plants to solar panels. Write in simple language, and include a bulleted list of three key terms with definitions.”
 - *Strength:* Provides role, task, context, and format.
 - *Likely Output:* Engaging, age-appropriate, structured explanation.

This distinction mirrors what educators have observed in classroom applications of ChatGPT: weak prompts produce superficial responses, while structured prompts help generate content aligned with learning goals (Johnson, 2023).

Prompt Engineering in Education and Workflows

Prompt engineering is already influencing workflows across sectors:

- **Education:** Tools like Diffit generate personalized quizzes and reading materials based on structured teacher prompts, enhancing differentiated instruction (Chen, Martinez, & Lee, 2023). Similarly, QuestionWell uses prompts to create aligned assessments for diverse curricula.
- **Creative Arts:** Visual generators like DALL·E rely on descriptive prompts. Research notes that prompt specificity (e.g., “a watercolor painting of a rainy Paris street in the 1920s”) directly shapes artistic output (Gozalo-Brizuela & Garrido-Merchán, 2023).
- **Coding and Productivity:** Microsoft’s Copilot translates prompts like “write a function to sort a list of numbers in Python” into working code. However, weak prompts can lead to flawed or insecure outputs (Brown & Green, 2022).

- **Professional Writing:** In journalism and business, prompt design helps generate drafts, summaries, and translations. Clear role/task framing reduces factual errors and irrelevant outputs (Batista et al., 2024).

Across contexts, the **lesson is the same**: better prompts equal better outputs.

Interactive Activity: Weak-to-Strong Prompt Transformation

Exercise for learners:

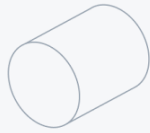
1. Provide a weak prompt:
 - *“Write something about climate change.”*
2. Ask participants to transform it into a strong prompt:
 - *“You are an environmental journalist. Write a 500-word article explaining the main causes of climate change for a general audience. Use simple language, avoid jargon, and conclude with three practical actions individuals can take.”*
3. Compare the AI outputs side by side.
 - The weak prompt produces a vague, general response.
 - The strong prompt produces a structured, audience-appropriate article with actionable insights.

This activity not only illustrates the importance of prompt engineering but also encourages **critical evaluation of AI outputs**.

2.4 Human-AI Synergy: Augmentation, not Replacement

One of the most important concepts in understanding generative AI is that it should **augment human intelligence rather than replace it**. This approach is often described as **“human in the loop” (HITL)**—a model in which humans and AI systems collaborate, with each contributing their unique strengths. Generative AI excels at speed, pattern recognition, and producing draft content. Humans, on the other hand, provide creativity, empathy, contextual awareness, and critical judgment. Together, they form a partnership that is greater than the sum of its parts.





Human in the Loop

The **human in the loop** approach means that AI systems are not left to make decisions or create outputs in isolation. Instead, they are supervised, guided, or edited by people. This model ensures that AI outputs are validated, aligned with ethical standards, and tailored to human needs. For example, in education, an AI system may generate a lesson plan or quiz questions, but the teacher remains responsible for reviewing, adapting, and contextualizing the material. This ensures that cultural relevance, pedagogical appropriateness, and learner diversity are respected—things that AI alone cannot guarantee.

Complementary Strengths: AI + Human

- **AI's strengths:**
 - Processes vast amounts of information rapidly
 - Identifies statistical patterns invisible to humans
 - Generates drafts, summaries, or creative variations in seconds
- **Human strengths:**
 - Critical validation of accuracy and relevance
 - Empathy and emotional intelligence in communication
 - Ethical reasoning and accountability
 - Creativity informed by lived experience and cultural nuance

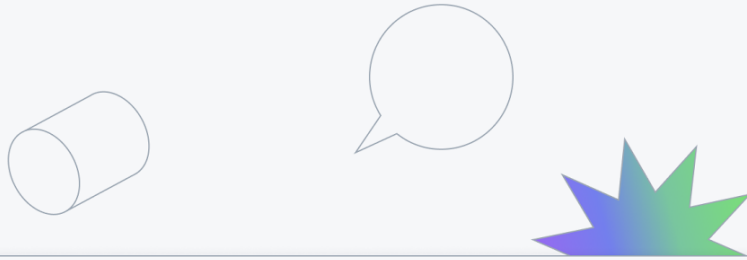
When these capacities are woven together, AI becomes a tool that **enhances human agency rather than diminishing it**.

Creativity Through Collaboration

Human-AI synergy is not only about efficiency—it also fosters **creativity**. AI can generate multiple perspectives or ideas that a human may not initially consider, acting like a brainstorming partner. Yet it is the human who selects, adapts, and integrates these ideas into meaningful work. In art, writing, or design, this partnership can expand creative possibilities without diminishing authorship.

As such, AI is best seen not as a competitor but as a **collaborative partner**, one that depends on human oversight to be trustworthy and impactful. As Erasmus+ learners and lifelong learners engage with AI, embracing this synergy will be key





to building a future where technology empowers, rather than replaces, human intelligence.

2.5 Limitations and Boundaries of Current Generative AI

While generative AI (GenAI) tools have demonstrated extraordinary capabilities, they are far from perfect. Their outputs can be persuasive and polished, but that does not guarantee accuracy, fairness, or reliability. Understanding the **limitations and boundaries** of these systems is essential for using them responsibly and avoiding misuse.

Hallucinations: Confident but Wrong

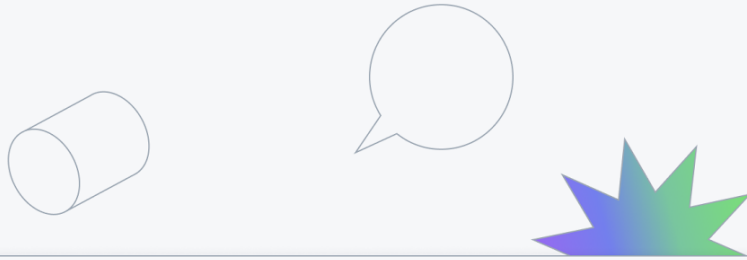
One of the most widely reported issues with GenAI is **hallucination**. This occurs when the model produces text that is grammatically correct, stylistically coherent, but factually incorrect. For example, a chatbot might invent academic references that do not exist or misstate historical facts with great confidence.

Because these outputs appear authoritative, users may accept them uncritically. This risk is especially serious in education and professional domains, where incorrect information can mislead learners or distort research (Ji, Lee, Frieske, Yu, Su, Xu, & Ishii, 2023). As scholars emphasize, plausibility is not the same as truth—and GenAI often confuses the two.

Lack of Factual Guarantees

GenAI systems do not have built-in mechanisms to verify facts. Unlike a database, they do not “know” truths but instead generate statistically likely continuations of text. This means they can produce content that sounds correct but lacks factual grounding.

For instance, if asked about a recent event that occurred after the model’s training cutoff date, the system may provide outdated or invented information. This limitation underscores why **human validation remains essential**.



Dependence on Training Data

Another boundary of current GenAI is its **dependence on training data**. Models are trained on vast datasets scraped from books, articles, and the internet. This brings three key issues:

1. **Bias:** Training data may contain stereotypes or imbalances. These biases can be reproduced or amplified in ML outputs. For example, image generators have been criticized for reinforcing gender and racial stereotypes in occupational roles (Mehrabi, Morstatter, Saxena, Lerman, & Galstyan, 2021).
2. **Outdated Knowledge:** Since training occurs at a fixed point in time, models cannot automatically update themselves. Information can quickly become obsolete, especially in fast-moving fields like science or politics.
3. **Data Gaps:** Some languages, cultures, or perspectives are underrepresented, leading to poorer performance for non-English speakers or marginalized groups (Bender, Gebru, McMillan-Major, & Shmitchell, 2021).

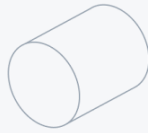
Over-Reliance and Erosion of Critical Thinking

A final limitation is not technical but educational: the risk of **over-reliance**. Because GenAI can produce answers quickly, students and professionals may become dependent on it for tasks like brainstorming, summarizing, or writing. Over time, this can weaken core human skills such as critical thinking, creativity, and independent problem-solving.

Educators caution that while GenAI is a powerful assistant, it should not replace the intellectual effort of learning. Studies on academic use of ChatGPT note that students must be guided to balance efficiency with integrity to avoid undermining their long-term learning (Yusuf, Pervin, & Román-González, 2024).

Gen AI offers remarkable opportunities, but its boundaries must be acknowledged. **Hallucinations, lack of factual guarantees, dependence on**





biased or outdated training data, and the dangers of over-reliance are all significant challenges. By recognizing these limits, learners and professionals can use GenAI more responsibly—treating it as a tool for augmentation, not as a substitute for critical judgment.

In short, GenAI should be seen as **fallible but useful**, powerful when combined with human oversight and weak when used in isolation. Awareness of its limitations is the first step toward effective, ethical, and sustainable use.



Chapter 3: Educational Best Practices

3.1 Generative AI in Teaching and Learning

Generative AI (GenAI) has quickly become one of the most discussed innovations in education. Its ability to generate human-like text, images, quizzes, and feedback provides both students and teachers with new ways to support teaching and learning. Research shows that while educators and learners express mixed feelings about GenAI and it replacing humans, they acknowledge its potential for improving efficiency, creativity, and personalization (Chan & Tsi, 2024; Ogunleye et al., 2024). This section explores the most common **use cases for students and teachers**, demonstrating how GenAI can complement traditional practices.

Use Cases for Students

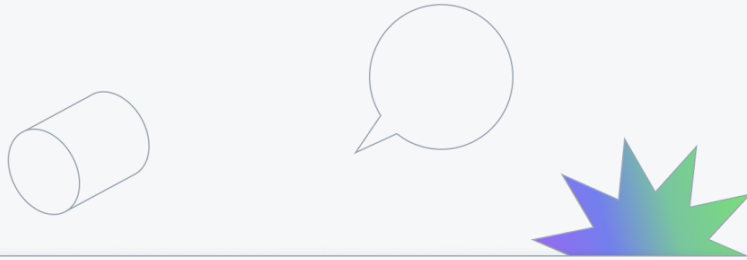
Study Help

One of the most immediate applications of GenAI is **study support**. Students use AI tools like ChatGPT to clarify complex concepts, generate explanations at different levels of difficulty, or produce summaries of long readings. GenAI can act like a 24/7 “study companion,” offering tailored feedback and helping learners practice problem-solving. For example, a student struggling with physics can ask for simplified step-by-step explanations, while an advanced learner can request challenging problems for extra practice.

Idea Generation

GenAI also enhances **creativity and brainstorming**. Students can prompt tools to suggest research questions, outline essays, or generate debate positions. According to Baidoo-Anu and Ansah (2023), this helps learners move past writer’s block and fosters deeper engagement with assignments by making it more personalized. Importantly, AI-generated ideas serve as starting points, not finished products. Students must still evaluate, refine, and integrate them into their work—developing critical thinking skills alongside creativity.





Practice and Feedback

Another valuable use case is **practice with instant feedback**. Language learners, for example, can engage in conversational practice with AI chatbots, receiving corrections real-time on grammar or style (Law, 2024). Similarly, AI can generate quizzes and self-check questions, enabling learners to test their knowledge independently. This capacity for low-stakes practice promotes self-regulation, a key skill for lifelong learning.

Use Cases for Teachers

Quiz and Assessment Creation

Teachers can use GenAI to generate quizzes, exam questions, and formative assessments aligned with learning outcomes. Khlaif et al. (2024) found that educators see potential in AI-assisted assessment design, especially for producing question banks that reduce workload. However, teachers emphasize the need for human review to ensure quality, fairness, and alignment with curriculum standards.

Lesson Planning and Content Development

AI tools can also assist with **lesson plan drafting**. Teachers might prompt AI to create a lesson outline on climate change for 14-year-olds, complete with discussion questions and interactive activities. Abunaseer (2023) notes that such applications can save time and free educators to focus on higher-value activities, such as adapting content for diverse learners. Moreover, GenAI can generate differentiated materials—for example, simplifying text for students with lower literacy levels or producing challenge tasks for advanced learners.

Grading Support

While fully automated grading remains controversial, AI can **support feedback and evaluation**. Kaplan-Rakowski and Grotewold (2023) report that many teachers are open to using GenAI to provide draft comments on student work, particularly in large classes where individual feedback is difficult. Teachers, however, remain the ultimate evaluators, ensuring that feedback is constructive, personalized, and fair. This reflects the principle of **human in the loop**, where AI augments but does not replace teacher judgment.



Opportunities and Challenges

The promise of GenAI in education lies in **efficiency, personalization, and creativity**. Students gain accessible study support, while teachers can reduce repetitive tasks and invest more energy in guiding, mentoring, and building relationships. At the same time, challenges must be addressed:

- **Accuracy:** AI outputs require careful review to avoid errors or bias (Su & Yang, 2023).
- **Equity:** Not all students or schools have equal access to GenAI tools, raising questions of inclusion (Ng, Chan, & Lo, 2025).
- **Ethics and Integrity:** Educators must set guidelines to prevent plagiarism and ensure responsible use (Ogunleye et al., 2024).

3.2 Case Studies: Diffit, Magic School, QuestionWell

While the potential of GenAI in education is often discussed in abstract terms, concrete examples show how these tools are already reshaping classrooms. Three platforms—**Diffit, Magic School, and QuestionWell**—illustrate how GenAI can personalize learning, support teachers, and make assessment more efficient.

Diffit: Adaptive Quizzes and Personalized Content

Diffit is designed to generate differentiated reading materials, quizzes, and practice questions tailored to a student's level of ability. By analyzing input such as a topic or text, Diffit produces multiple versions of the material at varying levels of complexity. For example, a teacher preparing a unit on climate change can receive reading passages written for beginner, intermediate, and advanced readers—all covering the same key concepts but at different levels of linguistic difficulty.

The benefit of this approach lies in **adaptive learning**. Research highlights that personalization improves comprehension and engagement by meeting students at their current level rather than forcing a one-size-fits-all approach (Ogunleye et

al., 2024). Teachers using Diffit report time savings in preparing differentiated resources, while studies note that adaptive quizzes and reading materials contribute to **improved test scores and learning retention** (Law, 2024).

By offering immediate access to customized content, Diffit supports inclusivity, helping both struggling learners and advanced students progress at their own pace.

Magic School: Automating Teacher Tasks, Enhancing Creativity

Magic School focuses on **reducing teacher workload** and encouraging creativity in the classroom. The platform provides ready-to-use lesson plans, classroom activities, and parent communication templates, all generated through AI prompts. For example, a teacher might ask Magic School to design a creative writing activity for 10-year-olds or generate a draft parent email explaining homework policies.

By automating these time-consuming but necessary tasks, Magic School enables educators to focus more energy on **interactive teaching and mentoring**. Kaplan-Rakowski and Grotewold (2023) found that many teachers see GenAI as a way to free up time for “human-centered” aspects of education—listening to students, guiding projects, or adapting lessons in real-time.

Another strength of Magic School lies in its ability to generate creative classroom activities. A teacher can, for instance, prompt it to design an interdisciplinary activity combining art and science, or to create debate topics aligned with a history lesson. Such applications support **active learning and student engagement**, which are critical for long-term knowledge retention (Su & Yang, 2023).

QuestionWell: Instant Quiz Generation with Visuals

QuestionWell is an AI-powered tool that generates quizzes and assessments aligned with curricular standards. Teachers provide a topic, text, or set of objectives, and QuestionWell instantly produces multiple-choice, short-answer, or open-ended questions. Beyond text-based questions, it can integrate **visuals**



into quizzes, enriching assessment formats and making them more engaging for learners.

Assessment creation is often one of the most time-intensive aspects of teaching. Studies suggest that GenAI-based quiz generation tools reduce teacher preparation time significantly, enabling quicker formative feedback cycles (Khlaif et al., 2024). The inclusion of images or diagrams within quizzes is especially valuable in STEM education, where visual representation aids comprehension.

Moreover, QuestionWell’s ability to produce a bank of varied questions supports **low-stakes practice opportunities** for students. Instead of repeating the same questions, learners encounter fresh, automatically generated items that test their understanding in different ways. This not only enhances assessment but also reinforces **critical thinking and problem-solving**.

Lessons from the Case Studies

Together, these three platforms illustrate the diverse ways GenAI supports both students and teachers:

- **Diffit** personalizes content and supports differentiated instruction.
- **Magic School** reduces teacher workload and fosters creativity.
- **QuestionWell** accelerates assessment creation while improving engagement through visuals.

They also reflect broader trends identified in the literature: personalization, efficiency, and inclusivity are at the core of GenAI’s promise in education (Ng, Chan, & Lo, 2025; Ogunleye et al., 2024). At the same time, these case studies underline the importance of **human oversight**—teachers remain responsible for checking accuracy, ensuring alignment with learning goals, and adapting materials for context.

3.3 Supporting Digital Literacy and Critical Thinking

As generative AI tools become more common in classrooms, their educational value depends not only on access but also on **how students use them**. To avoid



over-reliance and misinformation, teachers must help learners develop strong **digital literacy and critical thinking skills**. These competencies ensure that students can evaluate AI outputs, verify information, and use technology as a complement to their own reasoning rather than a substitute.

Teaching Students to Verify AI Outputs

GenAI tools can produce fluent, convincing answers that are not always factually correct. This makes **verification** a cornerstone of responsible use. Students should be taught strategies such as:

- **Cross-checking** AI-generated content with trusted sources (academic articles, official reports, or reputable websites).
- Looking for **internal consistency**: does the AI's response contradict itself or established knowledge?
- Using AI for brainstorming, but confirming details through independent research.

Studies on AI in education stress that teaching verification helps prevent blind acceptance of AI outputs, fostering **critical digital literacy** (Ogunleye et al., 2024).

Encouraging Fact-Checking and Proper Citation

Another vital practice is **fact-checking and citation use**. Students should be reminded that GenAI cannot guarantee accuracy, nor can it serve as a citable academic source. Instead, learners should treat AI as a **support tool** that points them toward concepts, which they must then verify through scholarly literature or primary sources.

In practice, teachers can:

- Require students to list the **sources** they used to verify AI outputs.
- Integrate activities where students compare AI responses with textbooks or journal articles.



- Discuss the importance of **attribution** and academic honesty, ensuring students understand plagiarism risks when copying AI-generated text (Yusuf, Pervin, & Román-González, 2024).

By embedding these practices into assignments, teachers encourage habits of **scholarly rigor**.

Promoting Reflective Use of AI

Beyond technical skills, educators should cultivate a reflective mindset in students. A key question to encourage is: “**What can I do better than AI?**” This helps learners focus on their unique human strengths—creativity, empathy, contextual judgment, and critical thinking.

For example, AI may generate a well-structured essay outline, but students should reflect on how they can add personal insights, original arguments, or cultural relevance that the model cannot provide. In group discussions, teachers can ask students to analyze AI outputs: What is useful? What is missing? What is potentially misleading? This reflective practice turns AI into a **partner in thinking**, rather than a shortcut that erodes intellectual growth (Chan & Tsi, 2024).

3.4 Integrating GenAI into Formal and Non-Formal Education

Classroom Integration

In formal education, GenAI can be introduced in a structured way that enhances existing pedagogical practices. Researchers note that higher education institutions are beginning to adopt policies for the **ethical and innovative use of GenAI**, focusing on teaching applications that support, rather than replace, human learning.

Examples include:



- **Structured assignments:** Students may use AI to draft essay outlines, generate debate positions, or brainstorm project ideas, with the teacher guiding reflection and critical revision.
- **Creative projects:** AI can be used in art or design classes to propose initial sketches or variations, which students then adapt with their own style. Evangelidis et al. (2024) argue that AI-enabled art education expands creative possibilities while encouraging co-creation though subject to ethical implications.
- **Skill practice:** In STEM education, students can use AI to generate problem sets or code snippets, while teachers emphasize accuracy and error analysis.

Informal and Non-Formal Learning

Beyond schools and universities, GenAI also thrives in **non-formal learning spaces** such as youth clubs, Erasmus+ workshops, and hackathons. Research shows that non-formal projects foster **transferable metacognitive skills**—skills that learners later apply in formal contexts (Formosa, 2024). GenAI strengthens this by making learning interactive, creative, and collaborative.

Examples include:

- **Youth clubs** experimenting with AI-generated games or digital storytelling.
- **Erasmus+ workshops** where participants build “prompt libraries” and share best practices across cultures.
- **Hackathons** using GenAI for rapid prototyping, encouraging teamwork and problem-solving

These contexts highlight AI’s role as a **collaborative catalyst**, enabling young people to explore ideas and co-create knowledge outside the classroom.

3.5 Balancing AI Assistance and Human Creativity

While GenAI can accelerate workflows and spark ideas, there is a risk that over-reliance may erode human creativity. For this reason, educators stress the importance of **balancing AI assistance with uniquely human contributions**.



Encouraging Co-Creation

The most promising model is **co-creation**, where AI drafts and humans refine. In writing, for instance, a student might ask AI to generate an outline or first draft. The human task then becomes editing, adding arguments, and ensuring originality. Similarly, in art, AI may generate a set of design variations, but students integrate personal vision, emotion, and cultural relevance. Evangelidis et al. (2024) highlight that such co-creation in art education fosters exploration without undermining human authorship.

Creative Exercises

Educators can design activities that explicitly balance AI and human input:

- **Creative writing:** Students use AI to produce story starters, but they must develop the plot and characters themselves.
- **Visual arts:** AI generates initial images; students reinterpret them through painting, sculpture, or digital editing.
- **Design thinking:** In hackathons or group projects, AI provides brainstorming support, while humans evaluate feasibility, ethics, and innovation.

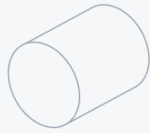
These exercises build both **digital literacy and creative resilience**, showing learners how to treat AI as a partner rather than a substitute.

Emphasizing Human Contributions

Human strengths—**empathy, ethics, imagination, and contextual judgment**—remain beyond the reach of current AI systems. Tomaszewska (2023) argues that in lifelong learning, GenAI can support skill development but cannot replicate human emotional intelligence or moral reasoning. Teachers should remind learners that their contributions extend beyond efficiency: their perspectives, values, and creativity give meaning to AI-generated outputs.

A useful reflective question is: “What can I add to this that AI cannot?” This promotes awareness of **human uniqueness** in an AI-driven environment.





Balancing AI assistance and human creativity ensures that GenAI enhances, rather than diminishes, learning. By encouraging co-creation, designing hybrid activities, and emphasizing human contributions, educators can safeguard creativity while embracing innovation. In both formal and non-formal education, this balance prepares learners to thrive in digital futures where AI is ubiquitous but human judgment and imagination remain irreplaceable.



Chapter 4: Ethical and Societal Dimensions of AI

AI is not only a technical phenomenon but also a social one. Its deployment affects economies, politics, education, culture, and individual rights. Understanding the **ethical and societal dimensions of AI** is therefore central to building systems that are trustworthy, inclusive, and aligned with democratic values. In Europe, this discussion is tightly connected to the **EU Artificial Intelligence Act (AI Act)**, the first comprehensive attempt to regulate AI globally. This section explores the key ethical principles, societal challenges, and policy responses shaping AI in Europe and beyond.

4.1 Ethical Principles for AI

Most frameworks for AI ethics converge on a few recurring principles:

- **Fairness and Non-discrimination:** AI should not reinforce or amplify biases based on race, gender, age, or other protected characteristics. Since AI systems often learn from historical data, there is a real risk of reproducing existing inequalities (Kusche, 2024).
- **Transparency and Explainability:** Users and stakeholders should be able to understand how AI systems reach their outputs. Black-box models undermine trust, especially in sensitive sectors like healthcare or law (Rosemann & Zhang, 2022).
- **Accountability:** Clear responsibility must exist for decisions supported or made by AI. This includes liability for harms and oversight mechanisms.
- **Privacy and Data Protection:** AI systems rely on vast amounts of personal data, making respect for the GDPR and related frameworks essential (Vesnic-Alujevic, Nascimento, & Polvora, 2020).
- **Human Autonomy:** AI should augment human capabilities, not replace or manipulate them in ways that undermine freedom or dignity (Smuha et al., 2021).



4.2 Societal Implications

The societal impact of AI extends beyond technical risks. Kusche (2024) highlights that AI should be analyzed within **risk society theory**: modern societies are increasingly shaped by risks that are uncertain, global, and systemic. AI epitomizes this dynamic: its harms (bias, surveillance, misinformation) may be diffuse and hard to attribute, but they affect trust in democratic institutions and social cohesion.

Three domains illustrate these societal implications:

1. **Work and Labour Markets** - AI-driven automation reshapes employment. While AI creates new jobs, it also threatens traditional roles. Generative AI, for example, can automate aspects of content creation, customer service, or programming, raising concerns about displacement and inequality. Lifelong learning and reskilling are essential responses (Abadía et al., 2025).
2. **Democracy and Misinformation** - AI systems can generate deepfakes, misinformation, or manipulative content. This poses risks for democratic processes and public trust. Regulatory responses, such as watermarking requirements for AI-generated content, are under consideration in the EU AI Act (Butt, 2024).
3. **Health and Wellbeing** - AI in healthcare offers promise—early diagnostics, personalized treatment—but raises ethical issues around liability, data protection, and potential bias in training datasets (Rosemann & Zhang, 2022).

4.3 The EU Artificial Intelligence Act

The **AI Act**, proposed in 2021 and expected to be fully in force by 2026, represents **the world's first comprehensive AI regulation**. It adopts a **risk-based approach**, categorizing AI systems into unacceptable, high-risk, limited-risk, and minimal-risk categories (Butt, 2024).

- **Unacceptable-risk AI** (e.g., social scoring, manipulative systems) is banned outright.



- **High-risk AI** (e.g., biometric identification, medical devices, recruitment systems) must comply with strict requirements: transparency, human oversight, quality datasets, and accountability mechanisms (Musch, Borrelli, & Kerrigan, 2023).
- **Limited-risk AI** (e.g., chatbots) requires transparency to ensure users know they are interacting with AI.
- **Minimal-risk AI** (e.g., spam filters, video games) remains largely unregulated.

This regulatory framework reflects Europe’s **human-centric vision** for AI: technologies should respect fundamental rights, strengthen democratic values, and remain accountable to the public (Ebers et al., 2021).

4.4 Fundamental Rights and Risk

Kusche (2024) emphasizes that ethical discussions must be grounded in **fundamental rights**. The AI Act addresses risks such as discrimination, surveillance, and erosion of autonomy by aligning regulation with rights enshrined in the EU Charter. This ensures that AI systems are judged not only on efficiency but also on their compatibility with equality, dignity, and freedom.

For example, biometric surveillance is considered especially dangerous because it intrudes on privacy and may normalize constant monitoring of citizens. Hence, the AI Act introduces strict limits on facial recognition technologies in public spaces (Butt, 2024).

4.5 Trustworthy AI and Legal Trust

A key term in European debates is **trustworthy AI**. Smuha et al. (2021) argue that legal trustworthiness is as important as ethical guidelines. Citizens must know not only that AI systems are ethical in theory but also that they are bound by enforceable law. This requires standards, certification systems, and effective enforcement mechanisms—otherwise ethical principles risk becoming “toothless” commitments.

Trust is also linked to **transparency and disclosure**. Laux, Wachter, and Mittelstadt (2024) propose “ethical disclosure by default”: AI providers should disclose training data, system limitations, and potential harms as standard practice. This could help ensure accountability and foster informed public debate.

4.6 International and Comparative Dimensions

AI ethics cannot be understood only in European terms. Puran (2024) compares EU approaches to international perspectives, showing that while Europe emphasizes rights and trust, other regions often prioritize innovation and economic growth. This divergence creates tensions in global governance. However, by setting standards through the AI Act, Europe may influence international norms—just as GDPR became a global reference point for data protection.

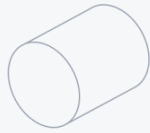
4.7 Challenges Ahead

Despite progress, several challenges remain:

1. **Implementation and Enforcement** – Translating ethical guidelines into operational practice is complex. Small and medium enterprises may struggle with compliance costs.
2. **Explainability vs. Performance** – More transparent models are not always the most accurate. Striking a balance is an open question.
3. **Global Competition** – Europe’s strict approach could slow innovation relative to regions with more permissive regimes, though it may also build long-term trust and resilience.
4. **Public Awareness** – Citizens often lack understanding of how AI works. Ethical frameworks must be accompanied by education and digital literacy initiatives.

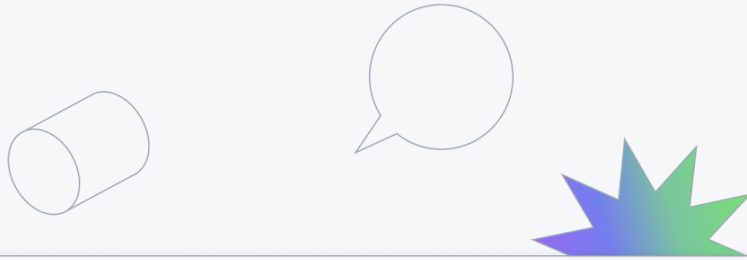
The ethical and societal dimensions of AI are inseparable from its technical design. Fairness, transparency, accountability, privacy, and human autonomy are not optional add-ons but core conditions for AI’s legitimacy. The European Union’s AI Act represents the most ambitious attempt to embed these values





into law, balancing innovation with fundamental rights. AI will continue to shape work, democracy, and social life. Whether it fosters trust or fear depends on how these ethical principles are translated into practice. For learners, policymakers, and citizens, the challenge is to remain engaged and informed, ensuring AI is a tool for empowerment rather than exclusion.





Chapter 5: Hands-on Training and Exercises

5.1 Getting Started with GenAI Tools

For many learners, the first step in using generative AI (GenAI) is simply knowing **where to begin**. With so many tools available, it can feel overwhelming. This section introduces four widely used GenAI platforms—**ChatGPT or Gemini, DALL-E, Bing Image Creator, and Suno**—and provides short, practical guides for getting started. It also outlines the difference between free and paid options so learners can make informed choices.

ChatGPT: Conversational AI for Text

What it does: ChatGPT is a conversational AI that generates human-like text. You can ask it to answer questions, explain concepts, brainstorm ideas, draft essays, or even simulate dialogues.

How to get started:

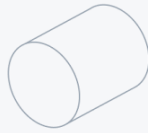
1. Go to chat.openai.com.
2. Sign up with an email or existing Google/Microsoft account.
3. Start by typing a question or instruction into the chat box, such as:
“Explain the water cycle in simple words.”

Tips for use:

- Be specific: “Write a summary of climate change causes in 200 words for high school students” works better than just “Tell me about climate change.”
- Use follow-up prompts to refine the response.

Free vs. Paid:

- **Free version:** Access to GPT-4 (good for most general uses).
- **Paid version (ChatGPT Plus):** Access to GPT-5, which is more accurate, better at reasoning, and capable of handling complex prompts.



DALL·E: Text-to-Image Generation

What it does: DALL·E generates images based on written prompts. It is especially useful for creative projects, presentations, or visual brainstorming.

How to get started:

1. Access through [OpenAI's platform](#) or directly inside ChatGPT (if using the Pro plan).
2. Type a descriptive prompt, such as: *"A watercolor painting of a futuristic city on floating islands."*
3. The tool generates several image variations you can choose from.

Tips for use:

- Be descriptive: Include style, color, perspective, or medium (e.g., "a black-and-white pencil sketch of a cat reading a book").
- Use iterations: If the first result isn't right, refine your prompt with more detail.

Free vs. Paid:

- Free credits are sometimes available when first signing up.
- After credits run out, additional image generations may require payment or subscription access through ChatGPT Plus.

Bing Image Creator: Free and Accessible Visuals

What it does: Bing Image Creator, powered by Microsoft's version of DALL·E, allows users to generate images from prompts directly through a browser.

How to get started:

1. Go to [Bing Image Creator](#).
2. Sign in with a free Microsoft account.
3. Enter a prompt like: *"A classroom of students learning with robots, comic-book style."*

Tips for use:



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- Experiment with tone words like “realistic,” “cartoon,” “3D render,” or “oil painting” to adjust results.
- Use “boosts” (free daily credits) for faster, higher-quality results.

Free vs. Paid:

- Bing Image Creator is **free to use** with daily credits.
- Users can purchase additional credits for faster results, but most casual use is fully covered by the free option.

Suno: Generative Music

What it does: Suno is a GenAI tool that creates original music tracks from text prompts. It’s popular among youth and creators looking to experiment with sound design without needing musical training.

How to get started:

1. Visit suno.ai.
2. Create a free account.
3. Enter a prompt describing your desired music, such as: “*A calm acoustic guitar track with relaxing vibes*” or “*Energetic electronic dance music with heavy bass.*”

Tips for use:

- Be clear about genre, instruments, and mood. For example, “*Jazz trio with piano, bass, and drums, upbeat and lively*” yields very different results from “*Slow cinematic soundtrack with strings and choir.*”
- Experiment with variations: Suno allows you to remix or regenerate outputs.

Free vs. Paid:

- **Free tier:** Limited daily generations, suitable for experimenting.
- **Paid plans:** Offer more generations, higher-quality downloads, and extended usage rights for creators who want to share music publicly.

Choosing Between Free and Paid Options

For beginners, the **free versions** of these tools are usually enough to explore their potential. Free tiers let learners test features, generate useful content, and gain confidence in using GenAI. However, frequent or advanced users may benefit from **paid upgrades**, which often provide:

- Access to more advanced models (like GPT-4).
- Higher-quality or faster outputs.
- More credits for generating images, music, or text.

Educators and youth facilitators can encourage students to begin with free options while discussing the ethical and practical implications of relying on paid services. This ensures learners are aware of accessibility issues and the importance of equitable access to AI tools.

As you understand, getting started with GenAI does not require technical expertise—just curiosity and experimentation. Tools like **ChatGPT** (text), **DALL·E** (images), **Bing Image Creator** (free visuals), and **Suno** (music) provide accessible entry points for both formal and non-formal learning contexts. By starting with free tiers and gradually exploring advanced options, learners can unlock the creative and educational potential of AI while maintaining critical awareness of its limitations.

5.2 Prompt Engineering Workshops (Beginner to Advanced)

To make the most of generative AI (GenAI) tools, learners need to practice **prompt engineering**—the art of writing effective instructions for AI systems. Prompt engineering workshops help participants build skills step by step, moving from basic commands to advanced techniques. This section outlines a **three-level framework**—beginner, intermediate, and advanced—that educators and facilitators can use to design workshops in both formal and non-formal settings.



Beginner Level: Simple Q&A and Summarization

Goal: Build confidence by learning how to ask AI clear, simple questions.

At the beginner stage, participants are introduced to the idea that AI responds differently depending on how questions are phrased. Activities focus on:

- **Q&A:** Learners ask basic factual or explanatory questions such as:
 - *“What is the capital of France?”*
 - *“Explain photosynthesis in simple words.”*
- **Summarization:** Learners practice asking AI to condense information:
 - *“Summarize this article in three sentences.”*
 - *“Give me the key points from this paragraph.”*

Workshop activity example: Split learners into pairs. Each asks ChatGPT or a similar tool a question, then compares outputs. How do slight changes in wording affect the response? This exercise shows the importance of **clarity and precision**.

Intermediate Level: Structured Prompts for Teaching and Learning

Goal: Move beyond short questions to create structured prompts that guide the AI toward specific outcomes.

At this level, participants learn the **components of strong prompts**: role, task, context, and output format. For example:

- *“You are a history teacher. Create a lesson plan on the French Revolution for 15-year-old students. Include three discussion questions, a short activity, and a five-question quiz.”*

This structured approach shows learners how to use AI to generate **practical outputs** like lesson plans, study guides, or quizzes.

Workshop activity example: Each participant writes a weak prompt (e.g., *“Tell me about the French Revolution”*), then transforms it into a strong one using the structured approach. Groups then compare results, highlighting how detailed prompts improve output quality.

Intermediate workshops can also introduce **iterative prompting**—asking follow-up questions to refine results. For example:

- First prompt: *“Create a lesson plan on climate change.”*
- Follow-up: *“Simplify it for students with limited English proficiency.”*

This teaches learners that effective use of AI often involves **conversation, not one-shot instructions**.

Advanced Level: Multi-Step Prompts and Role-Playing

Goal: Develop advanced skills in using GenAI for creative, complex, and interactive scenarios.

At this level, participants experiment with **multi-step prompts** and **role-based interactions**. These techniques unlock more sophisticated uses of GenAI in both formal education and non-formal activities.

- **Multi-step prompts:** Learners create sequences of prompts where each builds on the last. For example:
 1. *“Generate three possible essay questions about renewable energy.”*
 2. *“Write an outline for one of the questions.”*
 3. *“Draft a sample introduction paragraph.”*
 4. *“Suggest three sources to support this essay.”*

This mirrors real-world workflows, teaching participants how to use AI as a **project assistant**.

- **Role-playing prompts:** Learners assign the AI a persona, making interactions dynamic and context-specific. Examples include:
 1. *“Act as a debate coach. Help me prepare arguments for and against universal basic income.”*
 2. *“You are a recruiter. Ask me three interview questions for a marketing job and evaluate my answers.”*

Role-playing exercises highlight the flexibility of GenAI, showing learners how AI can act as a tutor, coach, or collaborator depending on how prompts are framed.

Workshop activity example: In groups, learners design a role-playing scenario (e.g., AI as a debate coach, travel guide, or coding mentor). They test their prompts, then share insights on how role instructions changed the quality of responses.

5.3 Designing Educational Prompts for Different Subjects

One of the most effective ways to integrate generative AI (GenAI) into education is through **subject-specific prompts**. By tailoring instructions to the needs of each subject, teachers and learners can unlock AI's potential as a study assistant, creativity booster, or problem-solving partner.

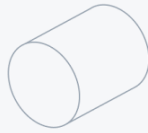
Below are examples of **prompts for different school subjects**, followed by a cross-disciplinary activity that helps students see how the same AI tool can adapt across contexts.

Language Learning

Language learners benefit greatly from GenAI because it can act as a **conversational partner, grammar coach, or cultural guide**.

Example prompts:

- *"You are a Spanish teacher. Create a dialogue between two friends meeting at a café. Write it at an A2 level, with English translations below each line."*
- *"Correct the grammar in this paragraph I wrote in French, then explain the rules I broke in simple terms."*
- *"Generate ten practice sentences in German using the past tense, and provide the English translations."*



STEM (Science, Technology, Engineering, and Mathematics)

STEM subjects often require problem-solving and clear explanations. AI can support both practice and conceptual understanding.

Example prompts:

- “Explain *Newton’s three laws of motion* to a group of 12-year-olds using simple examples.”
- “Generate five math word problems on fractions for grade 6 students, with solutions.”
- “Write a short Python function that calculates the area of a circle. Include comments explaining each line.”

By framing the role and task clearly, teachers ensure that AI outputs align with specific learning outcomes.

Creative Writing

AI can provide starting points for creative writing, but the key is encouraging learners to **develop original stories** beyond what the model produces.

Example prompts:

- “Give me three different opening lines for a short story in the mystery genre.”
- “Write a short poem about the sea in the style of a teenager writing a diary.”
- “Suggest five creative writing prompts for a group of 14-year-olds to inspire short plays.”

This approach helps students overcome writer’s block while emphasizing their role as authors who expand and refine ideas.

History

In history education, GenAI can be used for **explaining events, generating debates, or creating timelines**.



Example prompts:

- *“You are a history teacher. Create a five-point summary of the causes of World War I for high school students.”*
- *“Write a fictional diary entry from the perspective of a young person living in Athens during the birth of democracy.”*
- *“Generate three debate questions comparing the French and American revolutions.”*

This type of activity encourages learners to critically engage with historical content and connect facts with empathy and imagination.

Activity: Adapting a Single Prompt Across Subjects

A powerful classroom or Erasmus+ workshop exercise is to **take one generic prompt and adapt it for different subjects**.

Base prompt: *“Explain climate change to a group of 15-year-old students.”*

- **Language Learning:** *“Translate a short explanation of climate change into Spanish at B1 level. Provide a glossary of ten key words.”*
- **STEM:** *“Explain climate change using scientific vocabulary suitable for grade 9. Include one graph of CO₂ levels.”*
- **Creative Writing:** *“Write a one-page short story from the perspective of a polar bear experiencing the effects of climate change.”*
- **History:** *“Compare how people in the 19th century and today would understand the concept of climate change.”*

This exercise shows learners how prompts can be adjusted to serve different purposes, reinforcing both subject knowledge and **prompt literacy**.

5.4 Collaborative Exercises: Building a Shared Prompt Library

In addition to individual practice, GenAI workshops can foster **collaborative learning** by encouraging participants to co-create prompt resources. A **shared**



prompt library is a collection of effective, field-tested prompts that learners and educators can use, adapt, and expand over time.

Group Activity: Creating and Testing Prompts

1. **Form groups** of 3–5 participants.
2. Each group is assigned a theme (e.g., science, creative writing, history, job skills).
3. The group brainstorms and writes **three prompts** designed for their theme.
 - Example (STEM group): “*Create a simple coding exercise in Python for beginners.*”
 - Example (Creative group): “*Generate three drawing prompts for an art class inspired by the Renaissance.*”
4. Groups test their prompts in real time using an AI tool (ChatGPT, DALL·E, Bing Image Creator, etc.).
5. Each group evaluates the outputs: What worked? What didn’t? How could the prompt be improved?

This activity teaches not only **prompt engineering skills** but also **collaborative problem-solving and peer evaluation**.

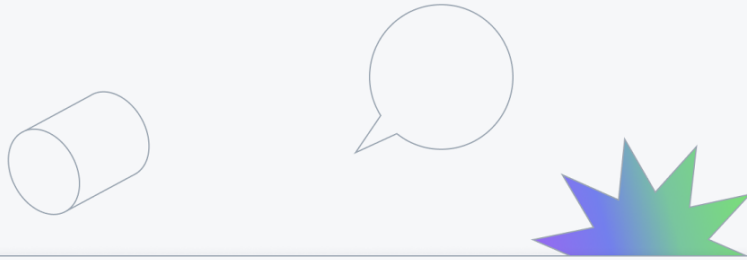
Sharing Results on a Common Platform

After testing, groups upload their best prompts to a **shared platform**. This could be:

- A **Google Drive folder** with categorized documents.
- An **online forum or learning management system (LMS)**.
- A **dedicated Erasmus+ project platform**, where international participants share prompts across countries and contexts.

Prompts should be organized by subject, difficulty, and purpose (e.g., “STEM – beginner coding,” “History – debate topics”). Over time, this becomes a **living resource library** that grows with each workshop or project cycle.





Benefits of a Shared Prompt Library

- **Sustainability:** Materials created in one Erasmus+ workshop can be reused and expanded by future groups.
- **Peer learning:** Participants learn from each other's creativity and approaches.
- **Inclusivity:** Prompts can be adapted for different languages, age groups, and learning levels.
- **Empowerment:** Learners move from being consumers of AI to **designers of learning experiences**.

Designing educational prompts across subjects shows how GenAI can support language learning, STEM, creative expression, and history. Activities that adapt a single prompt across multiple disciplines build both content knowledge and critical digital literacy. Meanwhile, collaborative exercises such as **building a shared prompt library** promote teamwork, reflection, and sustainability.

5.5 Reflection & Future Skills: Becoming an AI-Ready Citizen

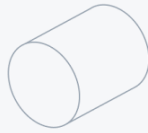
Generative AI has already become part of daily life for many young people, teachers, and professionals. From creating essays and images to supporting collaborative projects, it is no longer a futuristic concept but a practical tool. Yet, its rapid adoption raises a fundamental question: what does it mean to be an **AI-ready citizen**?

Reflection: Using AI Responsibly

The first step in becoming AI-ready is reflection. Tools like ChatGPT or DALL·E are powerful, but they are not neutral. They reflect the data on which they were trained, and their outputs are sometimes biased, incomplete, or factually incorrect. AI-ready citizens therefore cultivate a habit of **critical questioning**:

- Where did this information come from?
- Is this factually accurate?
- Am I relying on AI too much instead of developing my own ideas?





By pausing to ask these questions, learners ensure that AI supports their growth rather than replacing their agency.

Skills for the Future

Being AI-ready is not only about technical know-how but also about developing a mix of cognitive, social, and ethical skills:

- **Digital Literacy:** Understanding how AI systems work, their benefits, and their limitations.
- **Critical Thinking:** Evaluating AI outputs, detecting errors, and identifying bias.
- **Creativity:** Using AI as a partner in brainstorming and prototyping, while ensuring that uniquely human imagination and originality remain central.
- **Ethical Awareness:** Recognizing issues of privacy, fairness, and responsible use.
- **Collaboration:** Working with others in AI-supported environments, whether in school, youth clubs, or cross-border Erasmus+ projects.

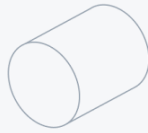
These skills mirror those emphasized in the EU's **Digital Education Action Plan** and lifelong learning strategies, linking the development of technical competence with democratic values and human rights.

Looking Ahead

As AI continues to evolve, so will the expectations placed on citizens. Just as previous generations had to master literacy, numeracy, and later digital fluency, the next step is **AI fluency**—the ability to understand, critique, and co-create with AI systems. This does not mean becoming computer scientists. Instead, it means learning how to integrate AI into everyday life thoughtfully, responsibly, and creatively.

The future of AI will also bring new challenges. Issues of misinformation, automation, and digital inequality will not disappear. But by combining lifelong learning, reflective practice, and active citizenship, young people can ensure that AI strengthens rather than undermines society.





Final Reflection Questions

To close this booklet, consider the following reflective prompts:

1. How can I use AI as a partner in learning and creativity without becoming dependent on it?
2. Which human qualities—such as empathy, ethics, or imagination—do I bring to my work that AI cannot?
3. How can I contribute to building a fair, inclusive, and responsible AI culture in my community, school, or Erasmus+ project?

By engaging with these questions, learners are not only preparing for the challenges of today but also cultivating the **future skills of AI-ready citizenship**. In this way, generative AI becomes not a threat to human potential, but a tool to expand it—when used with reflection, creativity, and care.



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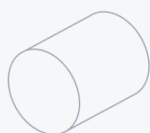
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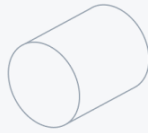
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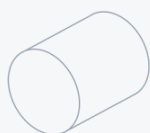
Annex: GenAI Prompt Library for Youth

*These prompts are designed for learners, but also for educators, and facilitators to help youth develop **AI literacy**, **creativity**, and **self-directed learning**. Each prompt can be used during Erasmus+ workshops, classrooms, but also for personal development & study sessions.*

1) Hyper-Personalized Learning & Skill Acquisition

#	Title	Prompt	Why effective
1	Personal Math Tutor (Quadratics)	Act as my math tutor. I'm struggling with quadratic equations. Explain the concept using everyday analogies (e.g., sports or cooking), then create 3 practice questions with step-by-step solutions and a quick checklist of common mistakes to avoid.	Relatable analogies + immediate practice build confidence. Add a photo of a worked problem or past test errors for tailored feedback.
2	Climate Article → Summary + Quiz	Summarize this 5-page article about climate change in ~150 words and create a 5-question MCQ quiz with brief rationales.	Synthesis + self-assessment; rationales reinforce learning. Upload the PDF/link to avoid hallucinations.
3	7-Day Python Starter Plan	Create a 7-day study plan to learn Python from zero, including free resources and 1 mini-project per day (≤30 minutes). End with a progress checklist.	Structures habit formation with bite-sized wins. Add your daily time window to increase realism.
4	Photosynthesis, YouTuber Style	Explain photosynthesis as a 2-minute script for teens, with hooks, analogies, and a closing call-to-action.	Story + hooks drive attention and recall. Specify audience age and tone (funny/serious).
5	Compare Vocab Platforms (B1)	Compare three free platforms for improving English vocabulary (B1). Rate on efficiency, engagement, and	Teaches tool evaluation + informed choice. Paste past tools to avoid repeats.





		mobile use; recommend one with reasons.	
6	EU Geography Flashcards	I'm preparing for an exam on European geography. Generate interactive-style flashcards for each EU country (capital, language, one cultural fact).	Curates targeted memory cues. Share syllabus to prioritize likely test items.
7	Spanish Paragraph Coach	Act as a language coach. Correct my short paragraph in Spanish, explain errors, and provide two similar example sentences for practice.	Feedback + pattern practice accelerates progress. Include level (A2/B1) and goals.
8	Renewable Energy Quiz (3 Levels)	Design a 3-level quiz (easy/medium/hard) about renewable energy for high-school students; include answer explanations.	Differentiated challenge + learning through explanations. Share curriculum unit for alignment.
9	Digital Citizenship Infographic Plan	Create a one-page infographic outline on digital citizenship (privacy, footprint, safety, ethics) with suggested icons/sections.	Forces concise, visual thinking. State audience (e.g., 14–16) to tune complexity.
10	"Explain AI to a Kid" Story	Explain how AI works to a 10-year-old using a fun story with characters and metaphors; end with two curiosity questions.	Narrative builds mental models; questions spark inquiry. Add kid interests (football, pets) to personalize.

2) Career Exploration & Pathfinding

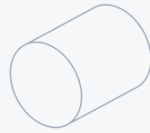
#	Title	Prompt	Why effective
1	Hybrid Careers: Art × Tech	I'm 19 and unsure about my future. Based on my interests in art and technology, suggest five emerging careers that blend both, with one first learning step each.	Expands options with concrete next moves. Add your portfolio/tools (Procreate, Blender) for fit.



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2	In-Demand Digital Skills (2025)	List three in-demand digital skills for 2025 and link free starter resources, plus a weekend micro-project for each.	Future-oriented + actionable. Note your time budget and device access.
3	Sociology—Non-Obvious Paths	I'm majoring in sociology. Suggest non-obvious careers using research/communication skills; include job-search keywords.	Broadens horizons and teaches keyword strategy. Paste one job ad you like.
4	3-Year UX Plan	Act as a mentor. Draft a 3-year roadmap to become a UX designer (skills, portfolio, internships, certifications) with quarterly milestones.	Structures long-term growth. Add current skills/city to match opportunities.
5	Top 5 Green Jobs (EU)	Research five green jobs in Europe and summarize needed skills/certifications; include an entry-level path per role.	Aligns employability with sustainability. Share languages/countries.
6	NGO vs Startup (Impact)	Compare working in NGOs vs startups for social impact: benefits, challenges, hiring pace, career growth, culture.	Supports informed decisions via trade-offs. Add location preference.
7	LinkedIn Headline & Bio	Draft a LinkedIn headline and 3-sentence bio for a student into sustainability/policy; include 5 keywords/hashtags.	Teaches concise self-branding and discoverability. Attach your CV for precision.
8	Remote Creative Roles	I want to work remotely in the creative industry. Suggest 5 job titles, required tools, and day-to-day tasks.	Clarifies expectations + skill gaps. Specify time zone/software.
9	Soft-Skill Self-Test	Create a short quiz to identify which soft skills to improve (communication, teamwork, time mgmt), with a mini plan per result.	Promotes reflection and next steps. Include recent feedback from teachers/mentors.
10	Erasmus+ Internship Pitch	Generate a 2-minute elevator pitch for an Erasmus+	Builds concise communication. Add hosting org name and role.



		internship in digital education + 3-line follow-up email.	
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3) Career Document Optimization & Interview Practice

#	Title	Prompt	Why effective
1	Resume Summary— Polished	Rewrite this resume summary to highlight teamwork/adaptability; ≤60 words; include 2 quantifiable achievements.	Sharpens impact. Attach your current CV/summary for accuracy.
2	CV Keyword Match	Analyze this job description and suggest how to align my CV (skills section + bullet verbs + missing keywords).	Teaches ATS-friendly alignment. Paste JD + CV.
3	Junior Data Analyst— Mock Qs	Act as an HR recruiter. Ask me 3 interview questions for a junior data analyst; then critique my answers with specifics.	Realistic practice + targeted feedback. Provide company/JD for nuance.
4	Sustainability Cover Letter	Write a motivational cover letter for a youth exchange focused on sustainability; emphasize community impact and learning goals.	Builds persuasive narrative tied to values. Add CV + project brief.
5	Action-Verbs Resume Bullets	Rephrase this resume bullet to be action-oriented and precise; keep one line and add a metric.	Improves clarity and measurability. Provide original bullet + numbers.
6	STAR Answers— Teamwork	Generate 5 STAR-format answers to teamwork questions (conflict, coordination, accountability, remote teamwork, deadlines).	Structures stories employers expect. Add real experiences to avoid generic answers.
7	CV Weak Spots— Coach	Act as a career coach. Identify weak spots in my resume (gaps, vague bullets) and suggest phrasing improvements.	Encourages reflective revision. Attach CV; note target sector.
8	Remote Marketing— Mock Interview	Simulate a mock interview for a remote marketing internship,	Builds fluency and realistic expectations. Paste internship ad.



		include 2 follow-ups and 1 take-home task brief.	
9	Pro Email Tips (Applications)	Give 3 tips for professional email during applications, with a follow-up template after 1 week.	Reinforces etiquette and timing. Include recipient role (HR/manager).
10	Polite Rejection Reply	Write a polite reply to a rejection that keeps the door open for future roles; keep it warm and concise.	Maintains relationships and networks. Add company/role for context.

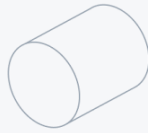
4) Project Acceleration & Creative Content Generation

#	Title	Prompt	Why effective
1	Climate Story Starters	Act as a creative coach. Generate 3 original story ideas on climate change + youth activism (protagonist, conflict, twist).	Sparks creativity with structure. Mention preferred genres.
2	Digital Wellbeing Campaign (3 Slides)	Create a 3-slide outline (problem, tips, call-to-action) with suggested visuals for a school campaign on digital wellbeing.	Combines design thinking + clear messaging. Add audience age.
3	Erasmus+ Video Script (1 min)	Draft a one-minute video script introducing an Erasmus+ youth project on inclusion; include hook, benefits, and CTA.	Encourages concise storytelling. Share project name and audience.
4	Sustainable Fashion Posts	Generate 5 creative social posts promoting sustainable fashion among youth (mix of tips, stats, challenges).	Drives engagement via variety. Specify platform (IG/X/LI).
5	Podcast Starter Kit	I'm creating a podcast. Suggest a title, theme, and 3 episode ideas about youth empowerment; add a simple cover-art concept.	Promotes planning and identity. State episode length.

6	GenAI & Inclusion Infographic	Develop an infographic outline showing how GenAI supports inclusive education (accessibility, personalization, ethics).	Reinforces synthesis + visual communication. Share target stakeholders.
7	Teamwork & Innovation Quotes	Write 3 short quotes about teamwork and innovation for a student project page.	Ready-to-use inspiration; tone-adaptable. Provide brand voice.
8	Exam-Stress App Brainstorm	Create a brainstorming plan for an app that helps students manage exam stress (features, onboarding, 1-week MVP plan).	Design-thinking with realistic scope. Mention platform (iOS/Android/web).
9	Ethical AI Blog (500w)	Draft a 500-word blog post on ethical AI for young creators (bias, consent, attribution) with 3 practical guidelines.	Builds digital responsibility with concrete actions. Add examples you care about.
10	Visualizing Inclusion Ideas	Suggest 3 creative ways to visually represent diversity/inclusion in educational campaigns (symbols, layouts, alt-text).	Encourages empathy-first design. Provide brand colors.

5) Productivity & Time-Management Automation

#	Title	Prompt	Why effective
1	Weekly Study Schedule (Pomodoro)	Create a weekly study schedule balancing coursework, rest, and hobbies; include Pomodoro breaks and offline time.	Encourages sustainable focus and balance. Share class times to avoid clashes.
2	10-Page → 1-Page Exec Summary	Summarize this 10-page policy report into a 1-page executive summary for youth readers with bullet key takeaways.	Trains synthesis and audience-fit tone. Upload the report for fidelity.
3	Mentor Feedback Email	Generate an email template to request feedback from a mentor on my project progress, incl. 3 specific questions.	Improves clarity and professional tone. Add mentor role + deadline.



4	Workshop Task Checklist	Design a task checklist for organizing a youth workshop (roles, deadlines, materials) with a simple RACI note.	Reinforces project management habits. Provide date & team size.
5	Focus Tool Recommendation	Act as a productivity coach. Suggest a digital tool to improve focus and how to use it, based on my device and habits.	Tailors tech-based self-regulation to context. Share device/OS.
6	Handwritten → Structured Notes	Convert my handwritten notes on AI ethics into a structured summary with headings and key terms.	Enhances organization and recall. Attach scans or typed text.
7	Cognitive Study Hacks	Generate 5 time-saving study hacks grounded in cognitive psychology (retrieval, spaced practice, interleaving).	Boosts learning efficiency with evidence-based tactics. Add subject for examples.
8	30-Minute Morning Routine	Plan a 30-minute morning routine that improves focus and mood for online learning days (movement, planning, hydration).	Supports wellbeing and readiness. Include wake-up time/constraints.
9	Assignment Tracker Workflow	Create an automated workflow using free tools to track assignments and deadlines; include reminders and a weekly review.	Teaches automation + accountability. Mention preferred tools (Google/Notion).
10	Weekly Reflection Prompt	Suggest a weekly reflection prompt to evaluate how I managed time/energy; include a 5-point rubric.	Builds self-awareness and continuous improvement. Tie rubric to your goals.