AI4AL
Engagement Kit
Methodology

Artificial Intelligence 4 Adult Learning

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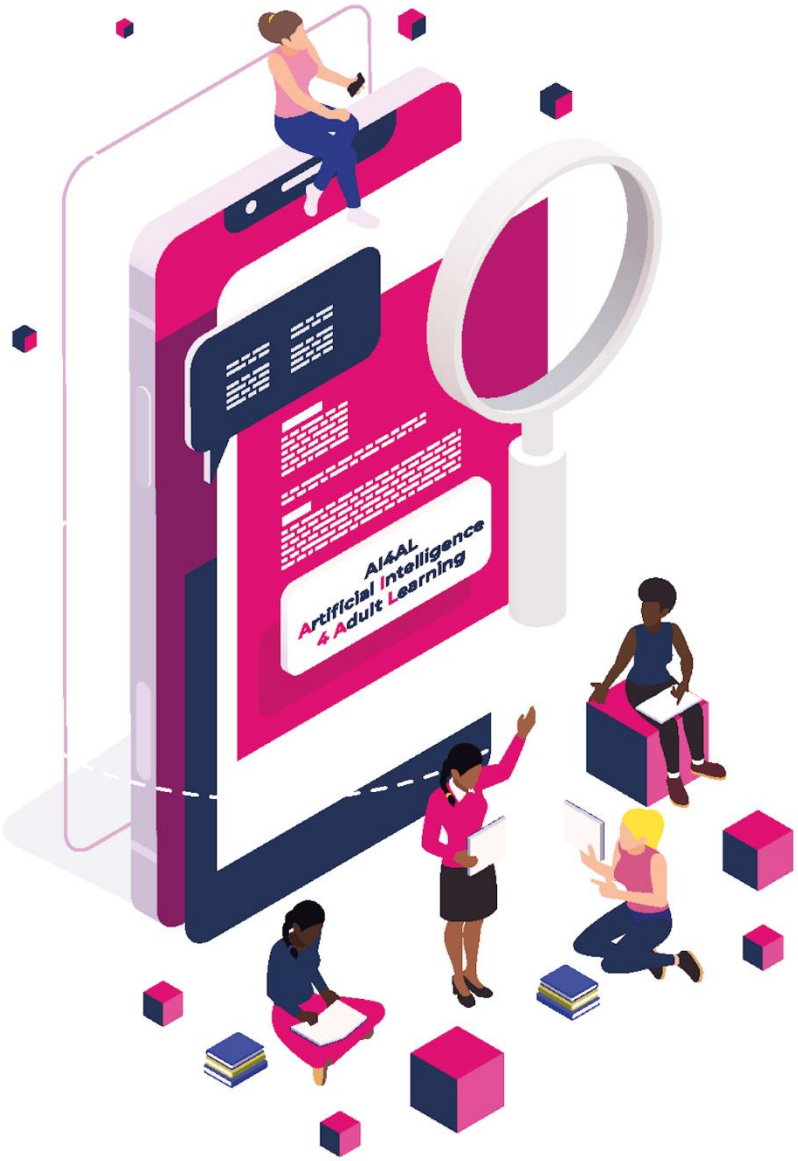

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1. Introduction

Artificial Intelligence is a field that boasts approximately 70 years of history, but it is only in recent times that it has started to garner widespread public attention, all thanks to the impressive outcomes displayed by some technological instruments that fall within its purview.

In truth, AI-based solutions like the ABS system in cars have quietly provided us with effective assistance for several decades. Nevertheless, it was the emergence of chatbots utilizing sophisticated language models that captured the public's imagination and ignited a wide-ranging discussion about the potential and risks of this technology. However, this debate often relies on incomplete information and a limited understanding of the true nature and full potential of AI technologies. It is a common scenario with emerging technologies, giving rise to the Four Horsemen of the Innovation Apocalypse: Confusion, Fear, Disillusionment, and Unrealistic Expectations.

This unwanted scenario naturally extends to the realm of adult education, with certain specificities.

Often when using technology in education, the problem is the lack of commitment and participation of the dedicated staff. Especially when AI is involved, the “fear” of not being able to articulate how a product works and why it works in a certain way is a significant barrier to adoption. The AI4AL project aims to address this problem by closing a loop from the input needed for AI to perform to the actual production of a product that leverages the data. The methodology aims to actively include educators as well as experts in the field by asking for their expertise (in terms of relevant transversal occupations and skills for a defined target group) that later will have a significant impact on the product.

This guide acts as the foundation of the strategy mentioned above. Its aim is to equip adult educators with the cognitive tools required to effectively utilize the toolkit and share experiences within the scenario repository. Indeed, the guide covers the fundamental topics for a demystified approach to AI.

It begins with an accurate definition of the core concepts and a concise historical overview that assists in appropriately contextualizing the cycle of unrealistic expectations and excessive disillusionment that has accompanied this research field. This contextualization is supported by a brief introduction to the most successful branches, including Machine Learning and Deep Learning. The theoretical section concludes with contemplations on the ethical implications of utilizing Artificial Intelligence and the risks of discrimination linked to an insufficiently considered and balanced data collection process.

Following is a more targeted analysis of the specific domain of adult education, encompassing the findings of a survey conducted among the initial educators engaged in the project. Intriguing insights arise concerning the factors deemed crucial for achieving success in the utilization of AI technologies within this sector. This chapter acts as a link to the guide's latter half, characterized by a more pragmatic approach, wherein actionable recommendations are furnished to effectively tackle two pivotal challenges: active engagement of educators and collection of high-quality data.

2. Fundamental Concepts of AI

2.1. Definition of Artificial Intelligence (AI)

Artificial intelligence is an area of technological development. It focuses on creating programs, machines and tools that can perform tasks that traditionally require human intelligence, e.g. learning or reasoning. They do so by using algorithms, and for the most popular forms of AI today, processing huge amounts of data and learning from that data.

Algorithms are at the core of AI. They are a sequence of instructions that defines how a machine processes data, learns from experiences, and makes decisions, which is the base for solving more complex problems. Possible tasks include:

- Differentiating between objects
- Grouping similar objects
- Self-driving cars
- Personalized recommendations on streaming platforms
- Advertisements on social media that you will relate to
- Language translation
- Text and image generation
- Facial recognition, e.g. face ID on phones

2.2. History of AI

While AI is becoming increasingly popular, its origins go all the way back to the 1950s when Alan Turing famously investigated the possibilities of intelligent machines. A lot has happened since then, and AI can be found as part of many visible and invisible tasks in everyday life. Over the decades, the development of AI has been marked by periods of growth and excitement, as well as periods of stagnation (commonly referred to as AI summers and winters), often depending on cycles of government funding put towards research[1].

Since 2010, the new bloom based on massive data and new computing power has enabled a massive acceleration in AI research and use. With this, AI-based tools are increasingly entering everyday use and awareness, and ethics and legal frameworks around AI are heavily discussed and being implemented through new regulations. However, what we discuss today builds upon 70 years of research, trial and error, and new approaches to see if machines could perform tasks that traditionally require human intelligence.

[1] Council of Europe. History of Artificial Intelligence. https://www.coe.int/en/web/artificial-intelligence/history-of-ai

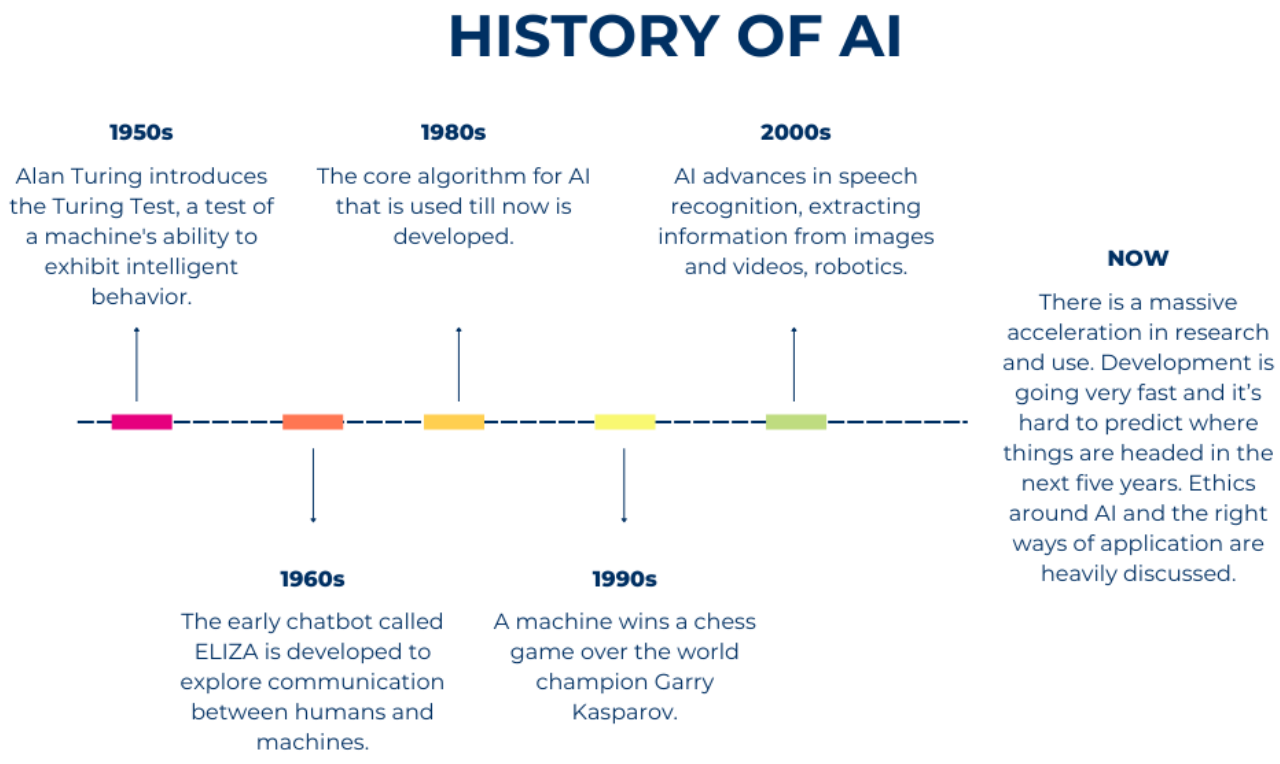


Figure 1: A brief history of AI.

2.3. Approaches to AI

There are many approaches to developing AI, such as machine learning, symbolic reasoning, evolutionary algorithms, and Bayesian networks. The success of **machine learning (ML)** has made it so that whenever people discuss AI they are most likely referring to this approach. **Deep learning (DL)** is a popular form of machine learning. However, while prevalent, machine learning is only one approach to developing AI.

2.3.1. Machine Learning

The basic premise of machine learning is to build algorithms that can receive input data and use statistical analysis to give some output. Those algorithms can learn from the data by recognizing patterns, and make predictions on new data. Put simply, the machine learns from data, rather than knowledge being manually put into it.

Common examples of ML applications include:

- Classification tasks
- Loan prediction
- Anomaly detection (spam messages, suspicious credit card transactions)
- Weather patterns
- Gas prices
- Clustering tasks
- Customers grouping

Machine Learning can be divided into two different learning types: **Supervised** and **unsupervised**. The main difference is the need for labeled training data.

For classification and regression tasks, the machine uses supervised learning, meaning that both data and labels for classification of the data are provided, telling the machine how to classify things. The machine then compares and sorts the data according to these pre-set labels.

For clustering tasks, unsupervised learning is used. In this case, data is provided but there are no labels. Instead, the machine clusters the data by itself.

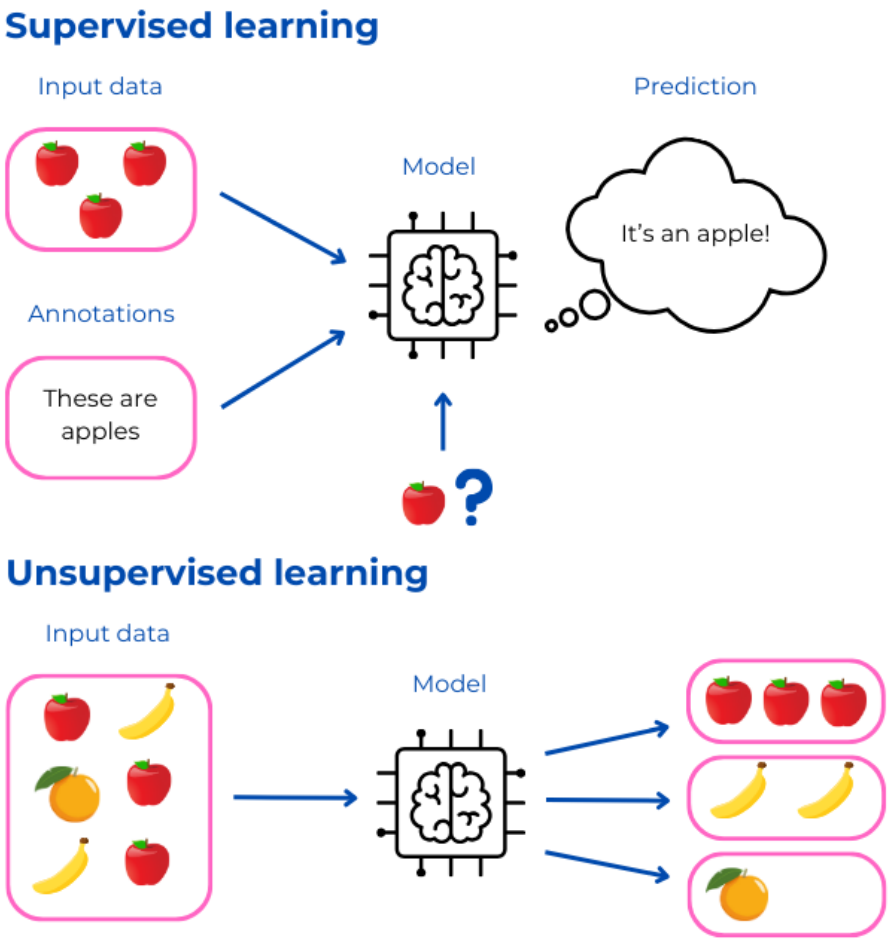


Figure 2: Supervised vs. unsupervised learning.

2.3.2 Deep Learning

Deep learning is a branch of machine learning which is completely based on artificial **neural networks**. These networks are modeled on the structure of the human brain. Between the input and output layers are various hidden layers that break down and transform the data.

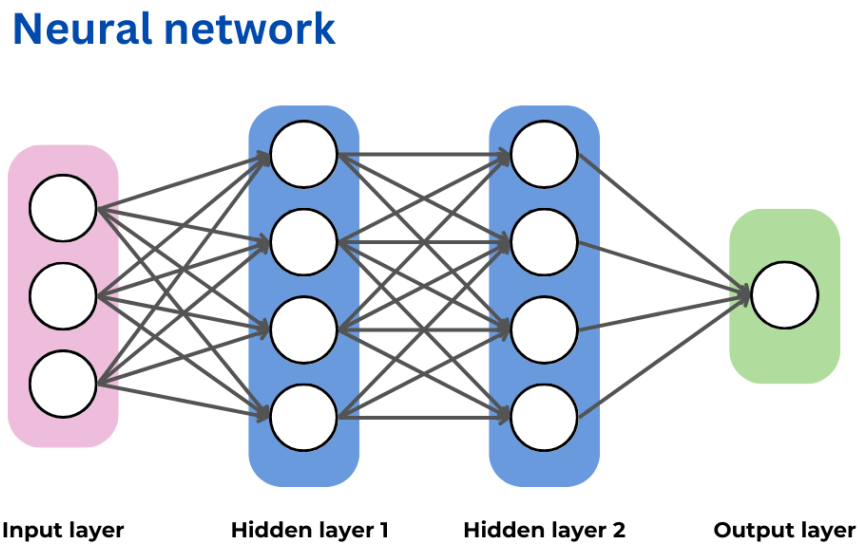


Figure 3: The different layers of a neural network.

A neural network has 3 types of layers:

Input layer

- Such as age, height, image pixels, etc.

Hidden layers

- This is where the power lies and data is processed and transformed. These layers can get highly complex.

Output layer

- The output we want to predict. (Will the person get the loan? Is it a banana or an apple in the image?)

When training neural networks, the process typically begins with a large dataset relevant to the specific problem. The neural network then learns from this data. This is done via the layers of interconnected neurons which are assigned weights. These weights determine how strong a connection between each neuron is and how much influence the input from one neuron has on the output of another. The crucial step in this training process is the comparison between the output generated by the network and the actual or expected output corresponding to the input sample. This comparison reveals the errors between what the network produces and what we need it to produce. To minimize these discrepancies, the weight of the neurons is adjusted. The objective is to fine-tune the network in a way that brings its output closer to the desired results. This weight adjustment is the essence of the training process and is carried out repeatedly as the network encounters more and more data. Through this process, the neural

network becomes increasingly capable of making accurate predictions or classifications for new, unseen data.

This way, neural networks can become highly accurate and serve numerous applications. However, they are very resource intensive through their need for large datasets and great computational power. Additionally, the theoretical explanations of how exactly the hidden layers work and interact, are currently still somewhat weak. Due to the complexity of the neural networks, it can be hard to determine how exactly an AI application arrives at certain outputs.

To summarize, AI isn't magic. Machine learning and deep learning primarily rely on two things:

Data: AI learns from data. In the best case, it learns the information that the data possesses.

- You don't have enough data? The AI won't work well.
- You have unclean data? The AI won't understand it's not clean.
- You have wrong data? Your AI program will learn that too!

Computer power: The stronger the computer, the better. However, high computer power is very expensive.

2.3. Ethical Considerations in AI

With the acceleration of AI use come many ethical considerations which have already been partially implemented by laws.

Bias and Fairness: The presence of unfair or prejudiced outcomes in the decisions or predictions made by AI systems. Bias arises to many factors including the following:

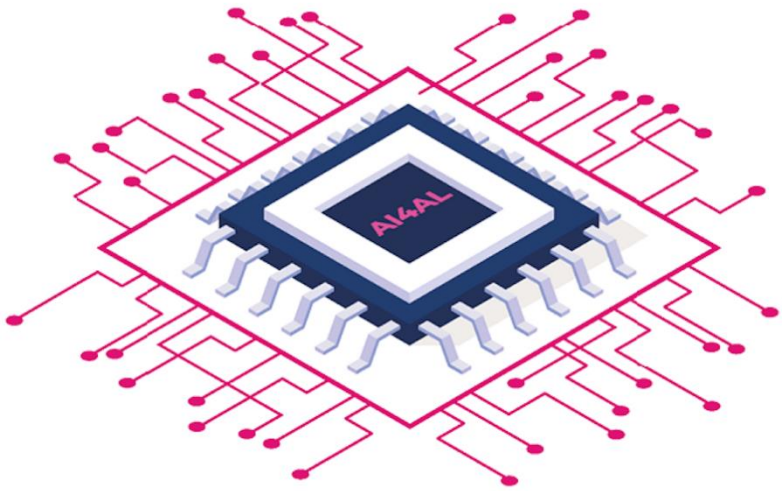
1. Historical data
2. Imbalanced or unrepresentative data
3. Unintentional assumptions in algorithm design
4. Unintentional algorithm - user design interactions

Regulation and Accountability: Many governments are slowly coming to realize that AI systems and the data collected by organizations who deploy such systems need to be regulated to ensure ethical behavior and protection of individuals and society.
For example, in the EU, such regulations can be found in the General Data Protection Regulation (GDPR) and the AI Act. In the USA, no country level regulation exists and different levels of protection apply to different states. Regulations concerning AI systems and data use currently differ greatly between countries and are still subject to development.

3. Applications of AI in Adult Learning

AI technology is making significant contributions to the field of adult education in three key areas: learning processes, assessment and feedback, and learner outreach. In terms of learning processes, AI is being used to create intelligent classrooms that provide interactive and immersive learning experiences. It also enables the development of adaptive and personalized content, tailoring educational materials to suit the unique needs and preferences of adult learners. Additionally, robotics and virtual assistants powered by AI are being utilized to assist in teaching and language learning, offering support and immediate feedback.

The use of AI in assessment and feedback is transforming the way adult learners are evaluated and guided. AI algorithms can automate assessments, including grading subjective assignments such as essays, saving time for educators and providing prompt feedback to learners. AI-powered tools analyze written work, offering constructive feedback on grammar, coherence, and relevance. Moreover, AI algorithms can track learners' progress and individual requirements, providing personalized recommendations and helping them plan their learning journey effectively.



Learner outreach is another area where AI is proving beneficial in adult education. Institutions leverage AI technology to improve learner engagement and support. AI plays a role in admissions processes by matching applicants with program requirements and streamlining administrative tasks. Furthermore, chatbots, driven by AI, are employed to interact with adult learners, providing timely responses to their inquiries and offering guidance. These chatbots are designed to understand natural language and deliver relevant information, thus enhancing accessibility and responsiveness.

By harnessing AI technology in these three ways, adult education is being transformed into a more personalized, efficient, and engaging experience. AI-enabled intelligent classrooms, adaptive content, automated assessments, and learner support systems contribute to the overall improvement of adult education, catering to the specific needs and experiences of adult learners.

3.1. Results of the preliminary AI4AL Survey

In order to solidify our positioning concerning the needs of the ALE sector in adopting AI processes the AI4AL partnership carried out a selectful qualitative survey with members of the EAEA- European Association for the Education of Adults and All Digital.

The survey included participants from various countries, including Germany, Spain, Italy, Latvia, Switzerland, Serbia, Cyprus, Greece, Belgium, Lithuania, and the European Union. The participants represented a diverse range of roles in the field of Adult Learning and Education (ALE), including adult educators/trainers, project managers, policy-makers, researchers, consultants, and content creators. Their years of experience varied, with some participants having over a decade of experience while others were relatively new to the field.The participants consisted of both males and females, spanning a wide age range from the mid-20s to over 70 years. This international and diverse representation highlighted the global nature of ALE and the valuable perspectives contributed by individuals from different cultural backgrounds. The participants' profiles showcased the multidisciplinary nature of ALE and the importance of collaboration and knowledge-sharing among professionals with diverse expertise and experiences.

The survey aimed to explore organisations' familiarity with artificial intelligence (AI) and its application in Adult Learning and Education (ALE). The responses collected shed light on participants' exposure to AI tools, their attitudes towards AI technologies, and their perception of AI's prospects in the ALE field.

Figure 4: Pictures from the Second Beta testing of the AI4AL matching tool in Zagreb, Croatia

Main Findings:

1. Familiarity with AI: The majority of respondents indicated being quite familiar with AI, having a basic understanding of how it works and recognizing its prevalence in everyday life, such as mobile phones.

2. Use of AI Tools: While some participants reported regularly using AI tools in various aspects of their lives, including ALE processes, others mentioned using them from time to time or never using them at all.

3. Attitudes Towards AI: Overall, the sentiment towards AI technologies was positive, with respondents expressing optimism about the opportunities and benefits AI can bring to ALE. However, a few individuals held neutral or somewhat negative attitudes, expressing concerns or fear regarding the future implications of AI.

4. Prospects of AI in ALE: Many respondents saw great potential in leveraging AI for ALE. They highlighted its ability to enhance employability opportunities, improve learning resources, provide assessments, and facilitate translation in multi-language MOOCs. Some emphasized the importance of AI literacy, critical thinking, and training educators in utilizing AI applications effectively.

5. Essential Factors for AI in ALE: The essential factors identified for utilizing AI in ALE included:

- Knowledge and understanding of AI applications in the domain by trainers and educators.
- Training and education of educators and students in new technologies, including AI.
- Awareness of the powerful applications of AI across various areas of life, along with a critical attitude towards information and results obtained from AI-based systems.
- Compliance with relevant regulations, such as EU GDPR legislation.
- Ensuring a balance between human knowledge and AI utilization, acknowledging the need for human expertise in managing AI and obtaining reliable conclusions.
- Promoting AI literacy and critical thinking among ALE practitioners.
- Building confidence in AI as a supportive tool for facilitators rather than a replacement, ensuring the emotional connection between adults and facilitators remains intact.

The findings indicate a general familiarity with AI among the respondents and a positive outlook on its potential in ALE. While embracing the benefits of AI, it is crucial to maintain a balance between human expertise and the utilization of AI tools in ALE.

It is recommended that ALE stakeholders, including trainers and educators, receive training on AI applications, fostering awareness of AI's capabilities and ethical considerations. Additionally, promoting AI literacy and critical thinking skills can enable ALE practitioners to effectively leverage AI tools and assess their outcomes.

By embracing AI responsibly and integrating it into ALE practices, there is a potential to enhance learning experiences, provide personalized support, and expand opportunities for adult learners.

4. Rules of engagement of educators when adopting AI-based technologies in ALE in the EU

As the field of education continues to embrace technological advancements, educators are increasingly exploring the use of Artificial Intelligence (AI) systems in teaching, learning, and assessment. AI has the potential to revolutionize education by providing personalized learning experiences, automating administrative tasks, and analyzing vast amounts of data to inform instructional practices. However, with the integration of AI in educational settings, it becomes crucial for educators to carefully consider the ethical implications of its use.

Ethical considerations play a fundamental role in ensuring that AI systems are deployed responsibly and in a manner that aligns with the values and goals of education. Educators hold a significant responsibility in shaping the minds and lives of their learners, and this responsibility extends to the ethical use of AI. They must carefully navigate the ethical dimensions of AI to safeguard the well-being, dignity, and rights of their learners while harnessing the potential benefits of these technologies.The "Ethical guidelines on the use of artificial intelligence (AI) and data in teaching and learning for educators"[2] underscore four key considerations: human agency, fairness, humanity, and justified choice. Human agency emphasizes the importance of individuals' autonomy, self-determination, and responsibility in shaping their lives. Fairness ensures equal access, opportunities, and non-discriminatory practices within the educational ecosystem. Humanity focuses on fostering meaningful human connections, respecting individuals' identity and well-being, and treating them as more than mere data objects. Justified choice emphasizes the transparent and collaborative decision-making processes that consider knowledge, facts, and data.

By integrating these ethical considerations into their decision-making processes, educators can navigate the complex landscape of AI in education more effectively. They can address potential risks such as bias, privacy infringement, discrimination, and unintended consequences. Moreover, by proactively considering the ethical dimensions, educators can ensure that AI systems support their pedagogical goals, enhance learning outcomes, and promote a positive educational environment for all learners.

In this context, educators need to be equipped with the necessary knowledge and skills to critically evaluate the ethical implications of AI systems. They must engage in a constructive dialogue with AI system providers and relevant stakeholders, asking pertinent questions regarding human agency, transparency, fairness, diversity, societal well-being, privacy, technical robustness, and accountability. These questions serve as a compass to navigate the ethical landscape of AI and guide educators in making informed decisions that prioritize the best interests of their learners.

As AI continues to shape the educational landscape, educators have a unique opportunity to harness its potential while upholding ethical principles. By embracing ethical considerations in the integration of AI, educators can ensure that these technologies serve as valuable tools for enhancing teaching and learning, fostering

[2] European Commission (2022). Ethical guidelines on the use of artificial intelligence (AI) and data in teaching and learning for educators, https://op.europa.eu/en/publication-detail/-/publication/d81a0d54-5348-11ed-92ed-01aa75ed71a1/language-en

inclusivity, and empowering learners to become responsible and informed members of society.

Figure 6: You can read the "Ethical guidelines on the use of artificial intelligence (AI) and data in teaching and learning for educators" published by the European Commission here

The European Commission's digital strategy aims to shape Europe's digital future and make it fit for the digital decade. The Digital Education Action Plan[3] is part of this strategy and focuses on fostering high-quality, inclusive, and accessible digital education in Europe. It emphasizes the need to address skills gaps, improve digital skills of educators and learners, and enhance the quality of teaching and learning.

The COVID-19 pandemic has accelerated the use of digital technologies in education but has also highlighted challenges in integrating digital tools effectively. The rapid development of Artificial Intelligence (AI) and its use in education has raised concerns about individualization, privacy, and equity. The European Commission has proposed a comprehensive legal framework for AI[4] to ensure a trustworthy and secure development of AI in Europe, with a focus on addressing digital competence and skills shortages.

To support the development of ethical guidelines on the use of AI and data in teaching and learning, the European Commission established an Expert Group on AI and data in education and training. The group conducted research, workshops, and discussions to provide insights into the ethics of AI and data use in education, while also outlining key concepts, ethical challenges, required competencies for educators, and ethical considerations related to AI and data in education.

[3] European Commission (2020). Digital Education Action Plan 2021-2027: Resetting education and training for the digital age. https://ec.europa.eu/education/education-in-the-eu/digital-education-action-plan_en

[4] European Commission (2022). Proposed Regulatory framework on Artificial Intelligence. https://digital-strategy.ec.europa.eu/en/policies/regulatory-framework-ai

The comprehensive report of the aforementioned group[5] highlights the potential of AI and data to transform education positively but also acknowledges the ethical dilemmas and risks involved, as well as emphasizes the importance of understanding the ethics of AI and the reasons for its use in education.

The report also outlines the competences educators need for the ethical use of AI and data in education and proposes rubrics to assess their ethical competence. It identifies four ethical considerations: agency, social fairness, humanity, and justified choice, and explores the ethical dilemmas and challenges associated with AI and data use in education.

Lastly, the report discusses existing European and international governance approaches that are relevant to the use of AI and data in education. It emphasizes the need for collaboration among stakeholders to implement ethical guidelines and ensure responsible and transparent use of AI and data in education.

In complementarity with the aforementioned report the final "Ethical guidelines on the use of artificial intelligence (AI) and data in teaching and learning for educators" provide essential visual material for educators to explore the world of AI.

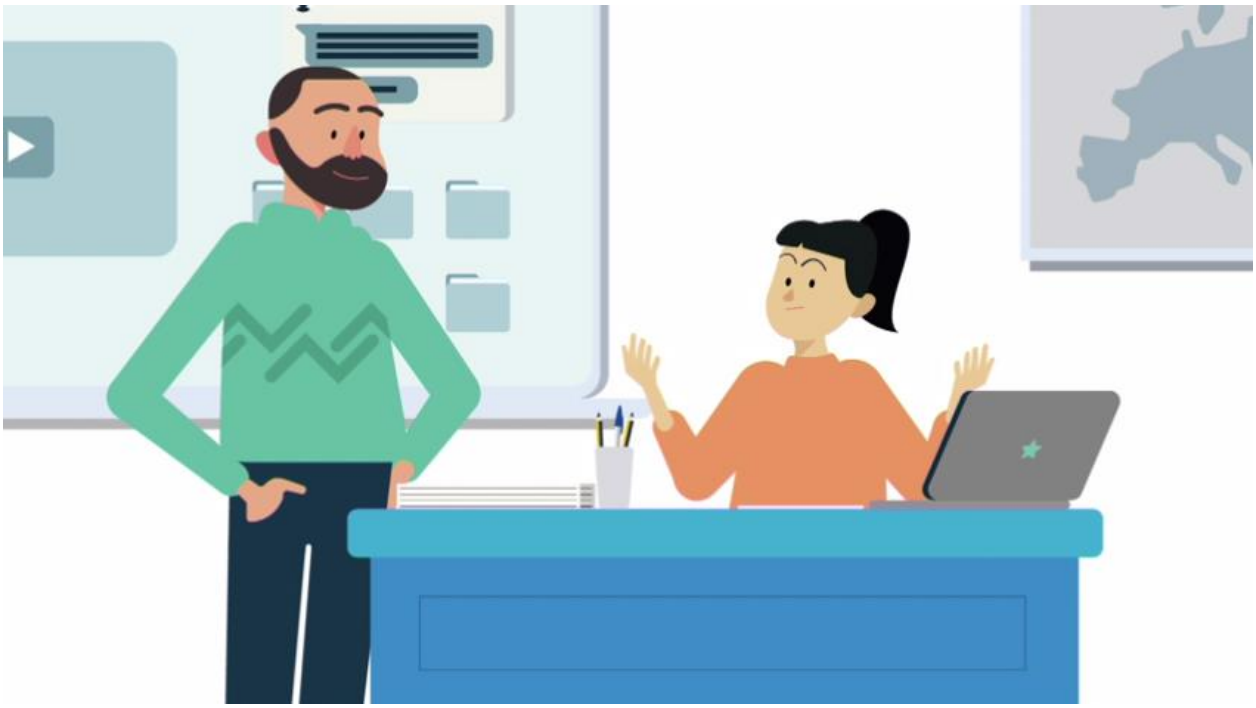


Figure 7: Scene from the Video to promote the launch of the Ethical guidelines on the use of artificial intelligence (AI) and data in teaching and learning for Educators.
https://audiovisual.ec.europa.eu/en/video/I-232180

To ensure trustworthy AI systems in education, key requirements are proposed in the guidelines. These requirements include human agency and oversight, transparency,

[5] European Commission, Directorate-General for Education, Youth, Sport and Culture, (2022). Final report of the Commission expert group on artificial intelligence and data in education and training – A executive summary, Publications Office of the European Union. https://data.europa.eu/doi/10.2766/65087

diversity, non-discrimination and fairness, societal and environmental well-being, privacy and data governance, technical robustness and safety, and accountability. They also address concerns such as bias, accessibility, privacy, and security.

Educators are encouraged to ask relevant questions when considering the use of AI systems. These questions revolve around human agency and oversight, transparency, diversity, non-discrimination and fairness, societal and environmental well-being, privacy and data governance, technical robustness and safety, and accountability. By engaging in a constructive dialogue with AI system providers and responsible bodies, educators can assess the ethical use of AI in education and develop awareness.

The guiding questions provided for educators cover various aspects of AI system implementation, ethical considerations, and practical issues. They help educators evaluate the impact, risks, and benefits of using AI systems in education, although a comprehensive legal or ethical assessment is still recommended. The questions cover areas such as teacher roles, system transparency, accessibility, discrimination prevention, societal impact, data privacy, technical robustness, and accountability.

Overall, we have to state that the aforementioned publications provide a foundation for the development of ethical guidelines on the use of AI and data in teaching and learning for educators, with the aim of promoting responsible and ethical practices in the digital education ecosystem, but it is always on the capacity of the organizations and educators to employ them.

5. Suggested Approach to Quality Data Collection

When working with AI applications, there are many criteria to assess data quality. The data you collect can be affected by many different issues. Good data quality is not just important in terms of completeness and accuracy, but also in its potential risks regarding the protection of personal data, fundamental rights, and discrimination[6]. Quality data practices are essential for ensuring that data-driven processes are reliable and ethical. To ensure such quality, it is important to consider common errors and shortcomings, such as errors of representation, measurement, and accuracy of the data.

In terms of representation, data may not comprehensively represent the population it's intended to cover. This can lead to underrepresentation or overrepresentation of certain groups or characteristics, causing biases in analysis and decision-making. Furthermore, data may suffer from measurement errors, where it doesn't accurately capture what it intends to measure. These errors can arise due to faulty instruments, human errors in data collection, or ambiguous measurement criteria. The accuracy of data is critical, as inaccuracies can distort analysis and the conclusions we draw from it. It's essential to assess the quality and reliability of the sources providing the data. Bias can creep into data due to various factors, such as biased sampling, historical discrimination, or human judgment. Biased data can perpetuate unfair or discriminatory practices when used in decision-making.

To assure that the data you collect is of high quality, you should be able to answer the following questions:

- Where does the data come from?
- Who is responsible for data collection, maintenance and dissemination?
- What information is included in the data?
- Is the information included in the data appropriate for the purpose of the algorithm?
- Who is covered in the data?
- Who is underrepresented in the data?
- Is there information missing within the dataset or are there some units only partially covered?
- What is the time frame and geographical coverage of the data collection?

[6] European Union Agency for Fundamental Rights (2019). Data quality and artificial intelligence – mitigating bias and error to protect fundamental rights. https://fra.europa.eu/en/publication/2019/data-quality-and-artificial-intelligence-mitigating-bias-and-error-protect

When collecting data, it is crucial to follow the principles of quality data collection, with consideration of the relevant EU laws, such as the General Data Protection Regulation (GDPR). These are some key points for best practice:

1. **Lawful basis**: Ensure that you have a lawful basis for collecting and processing personal data under the GDPR. This could include obtaining explicit consent from individuals, fulfilling a contract, complying with legal obligations, or performing a task in the public interest.

2. **Limiting purpose and minimizing data**: Clearly define the purposes for which you are collecting the data and ensure they are legitimate, specific, and compatible with the original purpose. Collect only the minimum amount of data necessary for your AI tool's intended purpose.

3. **Informed consent**: Obtain informed consent from individuals before collecting their personal data. Provide transparent information about the data you collect, how it will be used, and any third parties involved. Allow individuals to exercise their rights, such as accessing their data or withdrawing consent.

4. **Anonymization**: Anonymize personal data whenever feasible, particularly if it is not essential for the AI tool's functionality. Anonymization ensures that data cannot be linked back to an individual, thus protecting their privacy.

5. **Data accuracy and relevance**: Ensure that the data you collect is accurate, up-to-date, and relevant for the intended purpose. Implement processes to verify and update data periodically, and promptly address any inaccuracies or inconsistencies.

6. **Security and confidentiality**: Implement appropriate security measures to protect the data you collect from unauthorized access, loss, or alteration. Apply encryption, access controls, and other safeguards to maintain data integrity and confidentiality.

7. **Data retention and deletion**: Define clear retention periods for the collected data, keeping it only for as long as necessary to fulfill the specified purposes. Establish processes to securely delete or anonymize data when it is no longer needed or when individuals request erasure.

8. **Data transparency and accountability**: Be transparent about your data collection practices, providing individuals with information about how their data is being used. Maintain records of data processing activities, including the purposes, categories of data, and any sharing with third parties.

9. **Regular assessments and audits**: Conduct regular assessments of your data collection processes. If necessary, perform internal or third-party audits to ensure compliance with applicable EU laws and regulations.

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