AI PIONEERS
Artificial Intelligence in education & training

AI-Pioneers Toolkit
Resources for choosing and using AI tools in education

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CONTENT

ABOUT THE PROJECT

*The **AI Pioneers project**, under the ERASMUS+ Forward Looking Projects, is a multifaceted initiative aiming to integrate Artificial Intelligence (AI) into education, particularly in Adult Education and Vocational Education and Training (VET).*

The project focuses on various aspects.

***Impact of AI on Education**: The project acknowledges the transformative power of AI across all economic and social sectors, including education. It is recognized that AI can accelerate the achievement of global education goals by reducing barriers to accessing learning, automating management processes, and optimizing methods to improve learning outcomes. The European Digital Education Action Plan's[1] strategic priorities align with the project's objectives, which include developing a high-performing digital education ecosystem and enhancing digital competences for the digital transformation.*

***Reference Network of AI Pioneers**: A central component of the project is to establish a reference network of AI Pioneers, consisting of teachers, trainers, stakeholders, policymakers, and educational planners. This network will serve as a hub for the promotion and teaching of AI in Adult Education and Vocational Education and Training and it will act as a point of reference for the design and implementation of future AI-related educational projects at various levels.*

***Supplement to the DigCompEDU Framework**: Another objective is to develop a supplement to the European DigCompEDU Framework, outlining the skills and competences of educators related to AI in education.*

***Development of Resources**: The project aims to produce recommendations, toolkits, and implementation guidelines for AI Pioneers at both organizational and systemic levels. These resources will be disseminated to promote the use of AI in education and training.*

***Ethical Guidelines for AI Use**: The project will also focus on developing guidelines for ethical and trustworthy AI use in Adult Education and VET, in line with existing EU*

[1] https://education.ec.europa.eu/focus-topics/digital-education/action-plan

policies. This will include producing an evaluation schema and piloting these guidelines in practice.

***Dissemination and Mainstreaming**: The project includes a strong emphasis on disseminating its findings and mainstreaming its results into the wider educational landscape. This involves engaging participants in project activities and spreading the project results among other education providers, organizations, policymakers, and planners.*

***Project Management and Impact Analysis**: The project consortium, composed of various organizations, will manage the project through a structured approach, ensuring smooth development and implementation. Impact analysis will measure the project's effects on target groups at local, national, and European levels.*

Project partners

- *Institute for Technology and Education (ITB), University of Bremen, (Germany) Coordinator*
- *Associação Universidade-Empresa para o Desenvolvimento - TecMinho (Portugal)*
- *Active Citizens Partnership, (Greece)*
- *Centre for Action Research in Vocational Education and Training - CARVET, University of Verona (Italy)*
- *University of the Basque Country (Spain)*
- *Pontydysgu (Spain)*
- *European Distance and E-Learning Network - EDEN (Estonia)*
- *Federal Institute for Vocational Education and Training – BIBB (Germany)*
- *Centre for Social Innovation (Cyprus)*
- *CNOS-FAP Federation (Italy)*

www.aipioneers.org

1 WHAT IS THE AI-PIONEERS TOOLKIT?

The AI-Pioneers Toolkit is the main outcome of Work Package 4 (WP4-D4.2). It is a Knowledge Base (KB) aimed at teachers and trainers, designed to make tools and resources easily accessible to support the use of artificial intelligence (AI) in education. The information contained is the result of research actions and a discussion between experts that took place during the project.

Link to the Toolkit: https://aipioneers.org/knowledge-base/

1.1 CONTENTS AND TYPES OF MATERIALS

The toolkit offers a wide range of materials, including both tools and resources for the use of AI in education — such as software, guidelines, tutorials, and educational materials that facilitate the integration of AI into educational practices — and specific resources to teaching and learning AI. These include curriculum guides, lessons examples, practical exercises, and assessment tools for teaching fundamental AI concepts to students. It also includes curriculum recommendations, best practices, and guidelines on how to structure educational programs that integrate AI.

1.2 STRUCTURE AND ACCESSIBILITY OF THE TOOLKIT

The toolkit is designed to allow teachers and trainers to access the desired information according to their specific needs, both in terms of general education and professional development. All materials are offered as Open Educational Resources (OER), freely accessible and usable teaching resources for educators and trainers, which can be adapted and adopted at European, national and local levels for the continuous professional development of teachers. The resources are available in English and in the main languages of the project partners (Italian, German, Portuguese, Greek and Spanish) to ensure global usability. The overall goal of the toolkit is to facilitate the integration of AI into education through practical tools and educational resources, supporting both teachers and students in the process of learning and using AI.

2 DEVELOPMENT OF THE TOOLKIT

The quality of the toolkit's content is particularly high, as its development was based on:

- A systematic literature review
- An empirical data collection involving teachers and experts in the educational and training sector
- The consultation between the project partner experts and the members of the AI-Pioneers network

The following paragraphs briefly describe the main steps through which the information underlying the toolkit was obtained (see deliverable 4.1 - Tommasi et al., 2023).

2.1 LITERATURE REVIEW

The information derived from the literature review was obtained through a detailed systematic procedure. The method used follows the guidelines proposed by Briner and Denyer in 2012, specific to conducting systematic literature reviews in organisational studies in the social sciences and education. This approach emphasizes organisation, transparency, replicability and quality.

Initially, the main research question was defined, with several sub-questions focused on knowledge and evidence regarding the use of AI in training and education. Subsequently, a pilot research was conducted using relevant keywords in the Scopus and ERIC scientific databases, initially yielding 140,970 contributions. The research was refined with more structured extraction strings, limiting the analysis to English-language contributions published between 2019 and May 2023 and focusing exclusively on education and artificial intelligence. Strict inclusion and exclusion criteria have been applied, with a focus on education. Data extraction was carried out via a thematic analysis, with the results compared among the researchers to ensure accuracy.

In the end, 29 papers were selected for the final synthesis phase. The analysis produced a map of the impact of AI in education, highlighting the technologies used,

their uses and good practices, offering a comprehensive view of the use of AI in adult education and vocational training, as well as providing valuable insights for future research and practical applications. More precisely, the literature review in the document highlights that artificial intelligence (AI) in education offers significant tools such as Intelligent Tutoring Systems (ITS), Machine Learning (ML), and Augmented Reality (AR) which can enhance learning and training. AI has the potential to personalize education, improve teaching effectiveness, and increase accessibility and inclusivity. However, it also points out important challenges, including the need for adequate training for teachers and students, and addressing ethical and privacy issues associated with the use of these technologies (see deliverable 4.1 - Tommasi et al., 2023).

2.2 Empirical Research

The empirical research was carried out through a qualitative study based on an in-depth analysis of the experiences and opinions of practitioners in the education and training sector in different European countries. The methodology used combines semi-structured interviews with the Grounded Theory approach (Charmaz, 2006; Glaser et al., 1968), allowing detailed data to be collected and the perspectives of the interviewees to be explored in depth.

The interviews, a total of 13 experts in the field of adult education and vocational training, were conducted both in person and via digital platforms such as Skype, Google Meet, Zoom or telephone. The data collected were analysed according to the principles of Grounded Theory, identifying macro-topics emerging from the interviews, including:

- Project Development Status and Goals
- Origins of the initiative
- Disciplinary sectors involved
- Technologies used and technical requirements
- Educational Methodologies

This approach provided an in-depth understanding of the challenges and opportunities related to the integration of AI into education and training, providing a solid basis for developing effective educational strategies and promoting conscious use of AI.

As we delve into the research findings on AI integration in educational and training contexts, we uncover a landscape where projects are taking their initial steps, brimming with potential yet facing the challenges inherent to their nascent stages. These initiatives, though still developing, are not isolated experiments; they are collaborative ventures in which educators, students, and industry partners come together to forge a path toward a future enriched by technology. The goals of these projects are as diverse as they are ambitious. They aim to demystify the complexities of AI for both teachers and students, pilot cutting-edge hardware, and harness data in ways that could transform the educational experience. By teaching the art of crafting effective prompts, these projects empower users to unlock the full potential of AI tools, fostering a generation of adept and ethical digital citizens.

The sectors engaged in this endeavour span from robotics to graphics, from gaming to business, each with a vested interest in the AI revolution. The technologies employed are equally varied, including intelligent assistants and platforms that push the boundaries of creativity and innovation. Despite the advanced nature of these tools, the technical requirements remain accessible, ensuring that the benefits of AI can be widely disseminated. The educational methodologies adopted are as varied as the technologies themselves, catering to a spectrum of learning styles and preferences. From group work to practical activities, from lectures to interactive workshops, the approach to AI education is holistic and inclusive.

As we synthesize these findings, we are presented with clear operational recommendations for the successful integration of AI in vocational training. Building collaborative networks, engaging administrative bodies, promoting flexibility, and seeking state support are not merely strategies; they are the pillars upon which successful AI education initiatives are constructed. This research paints a picture of a sector on the cusp of transformation, where AI is not merely a tool but a catalyst for change. It is a call to action for educators, institutions, and policymakers to embrace

the possibilities that AI presents. As we look to the future, we envisage a workforce equipped not only with technical skills but also with the ethical understanding necessary to navigate the complexities of a digital world.

2.3 Identification of AI Technologies for Education

The analysis of the data collected through literature review, empirical research and discussion with project partners and members of the Pioneers Network led to the identification of a wide range of AI technologies that can be used for educational purposes. These technologies have been designed to understand how they can be useful to teachers, students and educational and training institutions. The technologies identified have been categorized according to their possible uses in education.

3 Description of the Toolkit

The toolkit was developed based on the needs expressed by the research participants and the AI-Pioneers network, which included the need to know:

- Concrete examples of the use of AI in education.
- The features of the new available AI technologies.
- Guidelines for the curricular application of new AI technologies.

The toolkit is structured to be a multilingual tool, allowing access to the desired content based on its practical use. The toolkit homepage offers:

- An interface to choose the language (English, German, Italian, Portuguese, Spanish and Greek).
- Three main content categories (Curriculum Recommendations, Best Practices, and AI Technologies).
- A collection of supplementary materials.
- A search bar.

The information is organized in a hierarchical structure. By clicking on the main categories, drop-down menus with the relevant subcategories and datasheets appear. The datasheets are designed to provide comprehensive but concise information.

The collection of materials includes a tutorial on how to use the toolkit, the original research report, and links to in-depth documentation.

The datasheets of the "Best Practices" and "AI Technologies" categories are structured to provide all the necessary information to the user. The "Best Practices" tabs are grouped according to the target of the case studies (students, teachers or institutions/organizations) and include details such as:

- Actors involved
- AI technologies used
- Scheduled Tasks
- Results
- Origin of the project
- Lesson Planning
- Technical Requirements
- External stakeholders
- Problems
- Links to external resources

The AI technologies mentioned in the fact sheets refer to the respective datasheet via hyperlinks.

The data sheets in the "AI Technologies" category are categorized by educational use and include information on:

- Characteristics - Describes briefly the features of the specific technology.
- Could be useful for - Examples of use in education and training.
- Examples - List of internal (cases or blog posts) or external links to practical examples of technology use in educational and training contexts.
- Account - indicates to the user whether or not it is necessary to subscribe to the service to be able to use it.
- Technical features: indicates whether the software can be used directly from the web (web-based) or if it is necessary to download it, etc.
- Link to the website.

- DigiCompEdu Areas: indicates the area of the DigiCompEdu framework in which the specific technology can be used.
- External material - Links to materials that can be useful for further exploration and/or to support the use of technology in educational and training contexts (books, videos, documents, etc).

Users can use the toolkit in three main ways: following the hierarchical categorization proposed by the authors; by using the search bar to find specific technologies or topics, or by using the search bar to find technologies based on the DigiCompEdu framework's categorization, by entering the specific name of the skill area given in the framework.

3.1 Open Structure and Open Educational Resources

Considering the rapid evolution of the AI topic, the toolkit is designed to be continuously updatable and integrable with new information. All the resources contained in the toolkit are designed to be downloaded and reused to create specific learning materials.

4 Possible uses of the AI-Pioneers Toolkit

The AI-Pioneers toolkit offers a wide range of practical uses, mainly aimed at teachers and trainers. Thanks to its structure and multilingual content, it can be used to integrate artificial intelligence into various educational and training contexts. Teachers can leverage the toolkit to access innovative educational resources that include tutorials, guidelines, and AI-specific software, thus making it possible to integrate advanced technologies into their daily lessons. For example, they can find practical examples of how to apply AI to personalise student learning, improve classroom management through automated monitoring systems, or even to develop new technological skills that are indispensable for the future job market.

Another practical use of the toolkit is the possibility of continuous professional development for teachers, who can take advantage of the available resources to keep up with the latest technological and educational innovations. The materials offered can support the design of school curricula that include AI, providing a solid foundation for

teaching the fundamental concepts of artificial intelligence in an accessible and applicable way.

5 POSSIBLE PRACTICAL USES

AI-Pioneers' toolkit offers a wide range of practical applications for both traditional education and adult education and vocational training, thanks to its organised structure and content available in multiple languages. This tool is designed to integrate artificial intelligence into various educational settings, promoting innovative and accessible learning. Teachers and trainers can leverage the toolkit to access advanced educational resources such as tutorials, guidelines, and AI-specific software, making it easy to include these technologies in daily lessons and tailoring learning to meet students' individual needs. For example, the toolkit provides practical examples on how to develop adaptive curricula that respond to students' diverse needs, and how to use intelligent chatbots and virtual assistants to improve instructional interaction. For adult education and vocational training, the toolkit is a crucial tool for upskilling in an ever-changing labour market. Trainers can use the toolkit's resources to integrate AI into their educational practices, creating courses aimed at learning new technologies. This is particularly useful for continuing education programs and for those engaged in retraining processes, allowing the development of tailor-made training programs that prepare workers to face the challenges of digitalization and automation. In this way, the toolkit not only helps to maintain workers' competitiveness in the labour market, but also fosters a dynamic and future-responsive learning environment.

6 IMPACT

The implementation of the AI-Pioneers toolkit can have a significant impact on traditional education, adult education and vocational training. The availability of multilingual resources allows for a widespread dissemination of innovative and advanced educational practices, adaptable to different local and regional needs. In the context of mainstream education, the toolkit can contribute to greater personalisation of learning, making education more inclusive and adaptive. Students can benefit from

educational approaches that use AI to provide real-time feedback, adapt content based on their performance, and promote more effective and engaging learning. For adult education, the toolkit facilitates access to lifelong learning opportunities, which are essential in an ever-changing work environment. The ability to keep up to date with the latest technological and methodological innovations makes workers more flexible and able to adapt to changes in the labour market, reducing the risk of skills obsolescence. In the field of vocational training, the toolkit can improve the quality and relevance of training programmes by providing participants with concrete and up-to-date skills. This contributes to a more qualified workforce prepared to face the challenges of digital transformation, improving the competitiveness of companies and fostering innovation in production processes and business models.

7 Ethical Implications of Using the Toolkit

The adoption of the AI-Pioneers toolkit also raises important ethical issues that need to be considered to ensure responsible and beneficial use of AI technologies in education and training. One of the main concerns is the protection of users' privacy and personal data. AI technologies often require access to large amounts of data to function effectively, and this can pose significant risks if the data is not handled securely and transparently. It is crucial that educational and training institutions adopt strict policies for data management, ensuring the utmost confidentiality of students' and course participants' personal information.

Another ethical implication concerns equity in access to technological resources. The widespread adoption of AI tools could exacerbate existing inequalities if some schools, universities or educational institutions do not have access to the same technological opportunities. It is essential that the toolkit's resources are distributed equitably and that mechanisms are put in place to ensure that all students, regardless of their socioeconomic background, have access to advanced educational technologies. This is particularly important in the context of adult education and vocational training, where access to resources may be more limited.

The increasing use of AI technologies in education and training can lead to an over-reliance on technology, reducing the importance of the human role. It is crucial that AI is seen as a tool to support and improve teaching, rather than replace human interaction, which remains critical to the emotional, social, and professional development of students and training participants. Finally, the introduction of AI technologies in education and training can have significant implications for employment. While AI can improve the efficiency and quality of teaching, there is a need to ensure that teachers and trainers are properly supported in adapting to these new technologies and that they are not replaced by automated systems. It is important to promote education that values human skills complementary to AI technologies, preparing both trainers and course participants for effective collaboration with emerging technologies. The ethical considerations surrounding AI use are of paramount importance. In the upcoming handbook produced in WP5 of this project, we will revisit and delve deeper into these issues.

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