STRATEGIES FOR APPLYING *AI* IN VOCATIONAL EDUCATION AND TRAINING. PREDICT: PRELIMINARY RESULTS AND IMPACT

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This paper intends to demonstrate and analyze strategies for applying AI in vocational education and training. In particular, it analyzes the preliminary results and their implications of the PREDICT: JOBS OF THE FUTURE WITH AI 4 VET INCLUSION project. The PREDICT project addresses the pressing challenges faced by the emerging workforce, particularly those graduating from vocational education and training (VET) programs. By formulating comprehensive strategies, the project aims to promote the inclusiveness, lifelong learning and mentoring that are critical to the career advancement of these individuals, especially those from disadvantaged backgrounds. Through a series of objectives, including developing a holistic digital reskilling model, addressing digital illiteracy, creating mentorship guidelines, promoting green digital tools, and establishing sustainable models, PREDICT seeks to equip VET students and other target groups with the necessary skills and readiness for the digital age. Ultimately, the project aims to empower individuals with digital resilience and readiness tailored to their individual needs, ensuring their successful integration into the evolving workforce landscape.

In this paper, we analyze the preliminary results, such as the manuals on green digital tools for innovative jobs and the IA course prototype, and their

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impact on the overall project. The impact is one of the most important indicators because the goal of this project is to create roadmaps, guidelines, blueprints, and other mechanisms that can be easily replicated or used by any of our European peers (be it an NGO, a company, an association or even a country).

***Keywords**: jobs; green digital tools; digital society; skills; VET; education; AI.*

INTRODUCTION

The rapid evolution of digital technologies and artificial intelligence (AI) is reshaping industries, economies, and the way individuals approach education and professional development. This transformation is particularly significant for vocational education and training (VET), which operates at the intersection of skill-building and workforce readiness. As industries increasingly demand professionals adept in digital and AI-driven technologies, addressing skill gaps has become not just a priority but an imperative. These challenges are especially acute for disadvantaged populations, who are often excluded from the benefits of digital transformation due to systemic barriers such as lack of access to resources, digital literacy, or tailored learning opportunities.

To address these critical issues, the PREDICT: JOBS OF THE FUTURE WITH AI 4 VET INCLUSION project emerges as a pioneering initiative. It leverages AI to develop innovative strategies, tools, and methodologies designed to empower VET graduates with future-ready skills. By combining cutting-edge technology with a strong focus on inclusivity, the project not only bridges skill gaps but also fosters digital resilience among learners, particularly those from underrepresented or marginalized backgrounds.

BACKGROUND AND OBJECTIVES

The PREDICT project is closely aligned with the European Union's (2020) strategic objectives to foster digital inclusion, sustainability, and lifelong learning. These objectives are interconnected with the growing need to prepare Europe's workforce for an economy increasingly defined by digital technologies, green innovations, and global competitiveness. Vocational education and training (VET) institutions are critical players in this ecosystem and are uniquely positioned to bridge the skills gap and meet the demands of a rapidly evolving labor market. However, these institutions encounter substantial challenges, including resource limitations, digital illiteracy among students and educators, and the necessity to adapt curricula to new economic and environmental realities.

The overarching objectives of PREDICT (2024) are threefold: firstly, to develop a holistic digital reskilling model (Taccle AI. 2021); secondly, to establish

inclusive mentorship guidelines; thirdly, to promote the use of green digital tools; and fourthly, to create sustainable lifelong learning frameworks. Collectively, these objectives are aimed at empowering VET graduates to succeed in the rapidly evolving workforce.

The PREDICT project has been developed to create an inclusive and adaptable reskilling framework with the aim of addressing the diverse needs of VET students and professionals. This model prioritizes the issue of digital illiteracy, which is a critical barrier to participation in the digital economy. By integrating foundational digital skills with advanced technological competencies, the framework ensures that individuals, regardless of their background, are equipped to thrive in technology-driven roles. Furthermore, the approach emphasizes personalized learning pathways, tailoring content and pacing to individual learners' needs and career trajectories.

PREDICT's strategy for fostering inclusiveness and long-term career success is predicated on mentorship. The project advocates for structured mentorship programmes that provide VET students with guidance, encouragement, and access to industry networks. By emphasizing personalized support, the mentorship guidelines focus on reducing barriers faced by disadvantaged groups, such as those from low-income backgrounds or underrepresented communities. Furthermore, mentors are trained to incorporate AI and digital tools into their practices, enhancing the effectiveness and reach of their support. The promotion of green digital tools is a fundamental pillar of the PREDICT project, aligning with the EU's Green Deal objectives. The development of resources such as manuals on green digital tools aims to bridge the gap between environmental consciousness and technological advancement.

The objective of these tools is to encourage sustainable practices within industrial contexts, with a view to imparting knowledge to VET students on the integration of eco-friendly approaches into digital workflows. By way of illustration, students may learn to utilize energy-efficient software, adopt paperless documentation processes, or optimize digital infrastructure with a view to reducing carbon footprints. The project prepares learners for innovative jobs that contribute to a greener future by equipping them with the relevant skills.

In today's rapidly evolving labor market, where technology and industries are constantly changing, sustainable models for lifelong learning are essential. PREDICT focuses on creating scalable and sustainable educational models that enable VET graduates to continuously update their skills and adapt. This objective includes developing roadmaps and blueprints that ensure the methodologies can be easily adopted across various contexts, from NGOs to national education systems. The project emphasizes sustainability in the learning process, ensuring the resilience of learners and institutions in the face of future challenges. The interconnectedness of these objectives engenders a comprehensive ecosystem designed to empower VET graduates. By addressing fundamental challenges such as digital illiteracy and mentorship gaps, while simultaneously promoting green innovation and lifelong

learning, PREDICT establishes a comprehensive platform for holistic workforce development. This convergence is of particular importance in preparing individuals for emerging roles that require a blend of technical, environmental and interpersonal skills.

Furthermore, PREDICT's emphasis on inclusivity ensures that the benefits of digital transformation extend to all segments of the population, including marginalized groups. In doing so, the project contributes to the EU's overarching goals and establishes a replicable model for fostering economic resilience and social equity on a global scale.

USING AI IN THE PREDICT PROJECT

The integration of Artificial Intelligence (AI) into vocational education and training (VET) systems represents a transformative opportunity to address evolving labor market demands and enhance the overall effectiveness of education and training frameworks. The PREDICT project, which leverages AI (Agarwal *et al*., 2023) as a central component, exemplifies how this technology can be harnessed to improve learning outcomes, foster inclusivity, and equip VET graduates with future-ready skills. This section explores the significance of AI within the PREDICT project and its broader implications for the VET sector.

AI as a Catalyst for Transformation in VET

Vocational education and training (VET) are inherently practical and industry-focused, aiming to prepare individuals for specific job roles and sectors. However, the accelerating pace of technological advancements has introduced new challenges, including the need for digital literacy, adaptability, and lifelong learning.AI serves as a critical enabler in addressing these challenges by personalizing learning experiences, enhancing skill development, and facilitating continuous learning.

AI-powered tools can analyses individual learners' strengths, weaknesses, and progress to deliver tailored educational content, which is particularly valuable in VET given that learners often come from diverse backgrounds with varying skill levels and needs. Through AI simulations and virtual environments, VET students can engage in hands-on training for complex or high-risk tasks, such as operating machinery or managing healthcare scenarios, in a safe and controlled setting. Additionally, AI-driven platforms enable on-demand access to training materials and resources, supporting lifelong learning and skill updates as industries evolve.

Role of AI in the PREDICT Project

In the context of the PREDICT project, AI is strategically employed to address key challenges and objectives, making it a cornerstone of the initiative's innovative approach. A key application of AI is the identification of digital illiteracy. AI-driven

tools are used to identify gaps in learners' digital skills and provide targeted interventions, ensuring that all students, regardless of their initial proficiency, can build a strong foundation in digital literacy.

AI also plays a crucial role in empowering mentorship models by providing data-driven insights and recommendations for mentors, enabling them to offer more effective and personalized guidance to their mentees. Furthermore, AI systems contribute to inclusivity by overcoming language and accessibility barriers. Features such as multilingual support, adaptive interfaces, and assistive technologies for learners with disabilities enhance accessibility and engagement. AI is also instrumental in creating green digital tools, optimizing sustainable practices such as energy-efficient digital workflows and resource allocation, aligning with the EU's green goals.

Implications for VET Stakeholders

The adoption of AI has significant implications for various stakeholders within the VET ecosystem. For educators, AI provides tools to enhance teaching efficacy, including automated grading, content creation, and real-time performance analytics. These technologies enable educators to focus on higher-value tasks, such as mentoring and addressing individual learner needs, rather than spending excessive time on administrative work.

Students benefit from AI-driven learning experiences that are interactive, gamified, and adaptive, enhancing their engagement and motivation. AI-driven career guidance tools can help students identify and prepare for emerging job opportunities by aligning their skills and aspirations with labor market demands. Likewise, employers stand to benefit from AI integration in VET, as it ensures a workforce that is not only skilled but also adaptable and proficient in leveraging advanced technologies. AI tools help align training programs with industry standards and skill requirements, ensuring that graduates are prepared for the evolving job market.

Broader Benefits of AI Integration

The integration of AI in VET (Dell'Acqua *et al.* 2023) is conducive to the fulfilment of broader societal and economic goals. A key benefit is the reduction of skills gaps, with AI facilitating the rapid development and deployment of targeted training programmes that align with current and future workforce demands. This ensures that industries have access to a well-prepared and agile workforce.

AI also plays a role in promoting sustainability by optimizing resource usage in both training and operational contexts, supporting environmental and economic sustainability. By streamlining processes and reducing waste, AI helps industries and educational institutions operate more efficiently while reducing their environmental footprint. Furthermore, equipping VET graduates with cutting-edge skills through

AI contributes to enhancing global competitiveness, fostering a more innovative and resilient workforce that can drive economic growth.

Challenges and Considerations

While the potential of AI in VET is significant, its implementation is not without challenges. Ethical considerations, particularly concerning data privacy, algorithmic bias, and the transparency of decision-making processes, must be addressed. Ensuring that AI systems are fair and unbiased is critical to maintaining trust and integrity in education and employment practices.

Another major challenge is the digital divide. It is crucial to ensure equitable access to AI technologies to prevent further marginalization of disadvantaged groups. Without proper infrastructure and resources, some students and institutions may struggle to benefit from AI-driven education and training opportunities. It is also essential to build capacity among educators and institutions by providing adequate training and resources to facilitate effective integration of AI into educational and employment practices. Without sufficient support, the full potential of AI in VET cannot be realized.

AI represents a transformative force in the VET sector (Çela, Vajjhala, and Eappen 2024), offering solutions to some of the most pressing challenges in workforce education and training. Through the PREDICT project, the integration of AI demonstrates its potential to personalize learning, enhance skill development, and support inclusivity and sustainability. While challenges remain, the thoughtful implementation of AI in VET can drive significant advancements in preparing individuals for the rapidly evolving demands of the 21st-century labor market. By addressing these challenges and leveraging AI's capabilities, initiatives like PREDICT not only contribute to individual empowerment but also to broader societal and economic resilience.

PREDICT METHODOLOGY

The PREDICT project employs a robust and adaptive methodology designed to align its objectives with the practical needs of stakeholders within the vocational education and training (VET) ecosystem. Using a collaborative and iterative approach, the project ensures that its strategies and outputs are both relevant and effective. The methodology integrates various stages of development, testing and feedback, fostering innovation while addressing the diverse requirements of VET institutions, learners and the labor market.

Stakeholder Engagement

A core principle of the PREDICT project is engagement with a wide range of stakeholders. This participatory approach ensures that the project's outputs are

grounded in real-world needs and challenges. Educators and trainers contribute valuable insights into current curricula, teaching methodologies, and gaps in digital and green competencies. Employers offer perspectives on industry demands, required skills, and emerging job roles shaped by digital and green transformations. The involvement of policymakers is crucial in aligning the project with national and European education and workforce strategies, ensuring scalability and sustainability. Vocational education and training (VET) students are actively involved to guarantee that the tools and resources developed are user-friendly, accessible, and tailored to the needs of diverse learner populations.

Stakeholder consultations are held at multiple stages, from conceptual design to implementation and evaluation. These consultations include surveys, focus groups, workshops, and iterative feedback loops, all of which contribute to refining the project's outputs and ensuring their effectiveness in real-world applications.

Prototype Development

To address its objectives, PREDICT emphasizes the creation and iterative refinement of prototypes. This process is essential for transforming theoretical frameworks into practical tools and resources that effectively support vocational education and training.

AI-based courses form a foundational component of this initiative, introducing key AI concepts alongside practical applications. These courses offer a blend of theoretical knowledge and hands-on experience, structured in a modular format that allows for easy adaptation to different learning contexts and individual needs. Green digital toolkits provide manuals and practical guides focused on sustainable practices within digital workflows. Designed to be industry-specific, these toolkits equip learners with actionable skills that contribute to environmental goals.

Reskilling frameworks and mentorship models undergo rigorous testing in pilot environments to evaluate their usability and effectiveness in addressing skill gaps. The development phase involves extensive testing with small user groups, followed by broader pilot implementations. Feedback is continuously integrated to refine and enhance the tools, ensuring their relevance and impact in real-world applications.

Impact Assessment

Measuring the success and scalability of project outputs is a critical component of the PREDICT methodology. The impact assessment framework focuses on three key dimensions: usability, scalability, and stakeholder feedback. Usability examines how well the tools and resources meet the practical needs of users, including their accessibility and ease of integration into existing workflows. Scalability assesses the adaptability and replicability of project outputs in varied educational and

institutional contexts. Stakeholder feedback is collected regularly through qualitative and quantitative data to ensure that the tools remain aligned with evolving demands.

Assessment methods include gathering user input through surveys and feedback forms, analyzing metrics such as course completion rates, satisfaction scores and skill improvement indicators, and conducting case studies to document the outcomes of implementation in pilot settings. These comprehensive evaluation approaches ensure continuous refinement and ensure the project's long-term impact.

The PREDICT methodology is characterized by a cohesive integration of three key components: stakeholder engagement, prototype development, and impact assessment. This integrated approach ensures that the project's outputs are innovative, relevant, and capable of making a meaningful contribution to the VET landscape. The dynamic nature of this methodology is twofold: firstly, it supports the immediate objectives of the project, and secondly, it establishes a replicable model for future initiatives.

PRELIMINARY RESULTS

The preliminary results of the PREDICT project demonstrate the transformative potential of integrating AI and sustainability-focused resources into vocational education and training, representing significant progress in addressing skill gaps, fostering inclusivity, and promoting lifelong learning. This section will discuss the project's major deliverables, which include manuals on green digital tools, an AI course prototype, and replicable mechanisms. It will also analyses their implications for digital literacy, lifelong learning, and broader implementation challenges and opportunities.

All resources developed within the PREDICT project are available online (https://predict.ipsantarem.pt/) and provided as open-access materials, ensuring that educators, students and institutions can freely access, adapt and implement the tools according to their specific needs. By removing barriers to access, the project promotes widespread adoption and encourages continuous learning in an increasingly digital and sustainable world.

Manuals on Green Digital Tools for Innovative Jobs

One of the key deliverables of the PREDICT project is a set of comprehensive manuals focused on green digital tools. These resources provide step-by-step guidelines for integrating sustainable practices into digital workflows, helping VET students develop a dual awareness of technological innovation and environmental responsibility.

The manuals are industry-specific, offering practical examples of how eco-friendly technologies can be leveraged across different sectors. For instance, they outline strategies for optimizing energy efficiency in IT systems, using renewable-

powered cloud solutions, and implementing circular economy principles in digital processes. By embedding these skills into VET curricula, the manuals prepare students to meet the growing demand for sustainable practices in the workforce.

The manuals also address the EU's broader Green Deal objectives, aligning the goals of environmental sustainability with the practical demands of industry. For VET students, this creates a unique learning experience that combines technical competencies with a forward-looking, eco-conscious mindset.

AI Course Prototype

The project's AI course prototype introduces VET students to foundational AI concepts and their applications, bridging the gap between theoretical understanding and practical experience. This resource emphasizes hands-on learning, ensuring that students not only understand AI technologies but also gain the confidence to apply them in real-world scenarios.

The course is structured to be modular, catering to learners with varying levels of prior knowledge. Topics range from an introduction to AI principles to advanced applications such as machine learning, natural language processing, and predictive analytics. Interactive elements, including AI-powered simulations and virtual labs, further enhance the learning experience by enabling students to experiment in safe and controlled environments.

By equipping learners with AI skills, the course prototype positions VET students for emerging roles in AI-driven industries, such as automation, data analysis, and robotics. This aligns with the EU's emphasis on digital transformation as a driver of economic growth and innovation.

Replicable and Scalable Mechanisms

The manuals and AI course prototype are supported by roadmaps, blueprints, and other mechanisms designed for replication and scalability. These tools provide clear frameworks for implementing the project's methodologies across diverse contexts, ensuring that the benefits are not limited to the initial pilot programs.

The scalability of these resources is a critical aspect of the PREDICT project's impact. Whether adopted by NGOs, vocational schools, private companies, or national education systems, the tools are designed to be adaptable to local needs and conditions. This adaptability makes the project a model for fostering widespread change within the VET landscape, promoting inclusive and sustainable workforce development across Europe.

CONCLUSIONS

The PREDICT project showcases the transformative potential of combining AI-driven resources with sustainability-focused tools in vocational education and

training (VET). By directly addressing digital illiteracy, particularly among disadvantaged groups, the project ensures that learners are not only equipped with essential digital skills but also develop an understanding of the environmental implications of their work. This dual emphasis creates a holistic learning experience that transcends traditional VET training, empowering underrepresented learners to fully participate in and contribute to the digital economy.

The project's commitment to lifelong learning further reinforces its alignment with the EU's strategic goals, offering flexible and scalable resources that enable continuous reskilling and upskilling. This adaptability ensures that VET graduates remain competitive in an era of rapid technological advancements and evolving industry demands. By fostering a culture of lifelong learning, the PREDICT project prepares individuals to navigate and thrive in a dynamic job market.

While the project has demonstrated promising preliminary results, challenges such as resource accessibility, resistance to new technologies, and ensuring equity in implementation highlight the complexities of transforming educational systems. However, the project's emphasis on replicable and scalable methodologies provides significant opportunities for broader adoption across various educational and institutional contexts. This not only enhances the project's impact but also establishes a model for integrating digital and environmental competencies into education systems at scale.

Ultimately, the PREDICT project positions VET graduates as leaders in the transition to a digital and sustainable economy. By equipping them with the tools to meet current and future workforce demands, the project is poised to make a lasting and meaningful impact on the VET sector, fostering inclusion, sustainability, and readiness for the challenges of the 21st-century job market.

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Această lucrare își propune să demonstreze și să analizeze strategiile de aplicare a inteligenței artificiale în educația și formarea profesională. În special, analizează rezultatele preliminare și implicațiile acestora în cadrul proiectului PREDICT: JOBS OF THE FUTURE WITH AI 4 VET INCLUSION. Proiectul PREDICT abordează provocările stringente cu care se confruntă forța de muncă emergentă, în special absolvenții programelor de educație și formare profesională. Prin formularea unor strategii cuprinzătoare, proiectul urmărește să promoveze incluziunea, învățarea pe tot parcursul vieții și mentoratul, elemente esențiale pentru avansarea în carieră a acestor persoane, mai ales a celor din medii defavorizate. Printr-o serie de obiective, inclusiv dezvoltarea unui model holistic de recalificare digitală, combaterea analfabetismului digital, crearea unor ghiduri de mentorat, promovarea instrumentelor digitale ecologice și stabilirea unor modele sustenabile, PREDICT urmărește să echipeze elevii din EFP și alte grupuri-țintă cu abilitățile și pregătirea necesare pentru era digitală. Scopul final al proiectului este de a oferi indivizilor reziliență digitală și competențe adaptate nevoilor lor specifice, asigurându-le integrarea cu succes în piața muncii în continuă evoluție.

În această lucrare analizăm rezultatele preliminare, cum ar fi manualele privind instrumentele digitale ecologice pentru locuri de muncă inovatoare și prototipul cursului de inteligență artificială, precum și impactul acestora asupra proiectului în ansamblu. Impactul reprezintă unul dintre cei mai importanți indicatori, deoarece obiectivul acestui proiect este de a crea foi de parcurs, ghiduri, modele și alte mecanisme care să poată fi ușor replicate sau utilizate de orice partener european (fie că este vorba despre un ONG, o companie, o asociație sau chiar o țară).

***Cuvinte-cheie**: locuri de muncă; instrumente digitale ecologice; societate digitală; competențe; educație și formare profesională; educație; inteligență artificială.*

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