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NEXT – Digital Transformations

for Supporting Next-Generation Labour

Deliverable {2.4}

Recommendations on learning resources content

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1 Introduction

The analyzed results of an expert survey, which are described in deliverables D2.1, D2.2, and D2.3 and related to the digital labor market segment, allow us to define both general and specialized skills necessary for an increase in competitive advantage and the possibility of finding a well-paid job upon graduation. This document provides recommendations applicable to development of training courses primarily for undergraduate students deprived of any experience related to working in the IT branch. The acquired results, however, may be useful for postgraduates, Ph.D. students, as well as other individuals interested in lifelong learning or demanding knowledge related to implementation of information technologies, artificial intelligence, augmented and extended reality, or 3D visualization.

This document presents recommendations on the development of learning resources for Work Package 3 (WP3), focusing on four essential aspects of 'digital' work. As technology continues to evolve rapidly, it is crucial to equip individuals with the necessary skills and knowledge to thrive in digital environments. The learning resources will address the following key areas:

Digital Technologies. In general, all of the aforementioned topics, including AI, AR, XR, etc., are covered in this chapter. The chapter is designed primarily to educate students without any experience in IT, specifically to teach them the basics of utilizing the already existing systems with AI (e.g. ChatGPT, Copilot, etc.), provide skills necessary for development of new intellectual systems for advertising companies on the IT market, and explain systems of intellectual monitoring, for example, AR Education Systems. In addition, students will be taught the fundamentals of applying 3D visualization and AI for website design, as well as receive new experiences related to many new types of digital activities present on the modern digital market, such as Metaverse and VR development, business consulting, virtual modeling and virtual marketing. Overall, by using the recommendations presented within this chapter, it is possible to create training courses capable of providing students with skills necessary to develop new elements of virtual reality like digital twins, create new man-computer communication interfaces, understand the fundamentals of mobile communications, get acquainted with the blockchain technologies, apply AI in cybersecurity and utilize cloud space technologies.

Because these guidelines are also offered to undergraduates in the humanities and natural sciences, this section includes courses that describe the use of numerical tools to solve typical problems in the humanities and ecology.

Soft Skills and Digital Ethics. Apart from technical competences, communication skills, and digital ethics also play a vital role in conducting successful activities in digital branch. Therefore, the following segment focuses primarily on the ethical issues of the digital world, as well as the development of communicational culture and ethical norms related to the code of conduct of all people engaged in activities in digital branch. The aforementioned components are very important in terms of establishing an efficient business relationship while utilizing digital technologies for data processing in human sciences and digital communication. They also allow to positively affect the

cooperation between developers and increase the success of their teamwork. Moral and ethical norms are also necessary for allowing transverse interaction of different branches of knowledge to establish effective cooperation between specialists with different knowledge, and thus combine those different technologies into a singular system while developing intercultural communication and competencies through mutual work.

Mental Health Awareness. The digital era brings unique challenges to mental well-being, including constant connectivity, information overload, and digital fatigue. As such, the following component focuses on skills necessary for preservation of mental health and dealing with mental issues, which are connected with working in VR or AR. Students will learn to understand both the positive and negative influences of digitalization, as well as how to retain a healthy mind within the digital environment.

By taking into account the aforementioned recommendations, it is possible to develop training courses to teach the developers to apply the knowledge of mental health to create appropriate man-computer communication systems for individuals with physical limitations, such as impaired sight, hearing, speech, etc. In addition, they can learn how to develop software or educational video games with text, speech, and gesture recognition.

Law Aspects in Digital Environments. With the expansion of digital activities, legal considerations become increasingly complex. The development of digital technologies and all related activities increases the complexity of legal relationships. Therefore, this chapter will also focus on researching the legal attributes of digital contracts, usage of digital technologies for exploratory research, specifically for patent information retrieval; protection of digital technologies as an intellectual property, and development of skills for cryptographic protection of personal data.

2 General requirements for learning materials

The topics of key areas are organized into courses. The courses are published in an online learning environment. Each developed course has to provide learners with the opportunity to understand basic principles, practical value, and possible applications in one of the above-mentioned key areas. In addition, these courses are designed to help acquire the skills (hard and soft) identified by experts (indicated in deliverable D2.3) that will be relevant to the next-generation digital labor market.

Below, we provide the recommended structure of a learning material (example for a topic with 20 pages; it should be applied proportionally to another extent):

- **Text Content**. One page of the learning materials can contain up to approximately 1800 characters. For this example, with 20 pages, the total number of characters is calculated as (20 x 1800) characters.

- **Worksheets**. 2 worksheets are mandatory components, designed to reinforce key concepts and facilitate the practical application of knowledge in digital work contexts.
- **Videos/Animations**. Materials should incorporate 2 videos or animations, each ranging from 2 to 7 minutes in duration, covering essential topics of course related to digital technologies contexts.
- **Images/Graphs/Tables**. The developed course should include 10 images, graphs, or tables throughout the learning materials to enhance visual understanding and illustrate key points across aspects of digital work.
- **Interactive/Advanced Elements**. Integration of 6 interactive or advanced elements (provided by an online learning environment) into the learning materials allows to engage learners actively and deepen their understanding. Several templates will be pre-defined for this purpose to facilitate the authors' work.
- **Self-Test Questions.** A course should include 20 self-test questions covering all the learning materials to assess learners' comprehension and retention of the content covered in aspects of 'digital' work.

- **Links to External Resources.** The additional requirement is to provide 2 links to external resources specifically for creating mind maps, allowing learners to explore additional materials or tools to support their understanding of digital work concepts.

Please note that the proposed structure is indicative and the ratio of individual components may vary, depending on the nature and specific requirements of each topic.

3 Recommendations for learning materials content

3.1 Digital technologies (artificial intelligence)

3.1.1 Augmented and virtual reality

The purpose. The course aims to teach the fundamentals of Augmented Reality (AR) and Virtual Reality (VR), their evolution, and distinctive characteristics. Students will understand how user-friendly AR and VR apps are designed and how to create engaging content for various applications. Additionally, the course seeks to enhance students' awareness of the global impact of AR and VR.

Skills and competencies. The general skills are based on an understanding of Extended Reality (XR), Augmented Reality (AR) and 3D Visualization (D2.3). They include 3D modeling and image processing.

The special skills in Extended Reality (XR), Augmented Reality (AR), and 3D Visualization (D2.3): development of AR Education Systems

Content. Introduction to AR and VR. Hardware and Software Basics. User Experience Design for AR and VR. Content Creation in AR and VR. AR and VR in Education and Training. Global Case Studies of AR and VR Implementation. Trends in AR and VR.

3.1.2 Virtual worlds development

The purpose. The objective of the course is to provide students with the knowledge and skills related to applying information technologies to develop the applications of augmented and virtual realities.

Skills and competencies. The general skills are based on an understanding of Extended Reality (XR), Augmented Reality (AR) and 3D Visualization (D2.3). They include 3D modeling; image processing. The special skills in Extended Reality (XR), Augmented Reality (AR), and 3D Visualization (D2.3): development of AR Education Systems.

Content. Digital world concepts. Design of the content for virtual worlds (two-dimensional images; three-dimensional objects; visual elements that vary with time (animation)). Augmented reality applications (application development based on web service technologies; application development based on unity technologies). Virtual reality applications (Application development based on unity technologies).

3.1.3 Immersive technologies

The purpose. This is a practice-oriented course. Based on Online and Remote Laboratories this course aims to instruct students on how different hardware and software can work and interact together. The content spans from microcontroller programming to control via desktop computers to communication with web interfaces using various protocols.

Skills and competencies. Skills according to D2.3: programming skills for ᴍetaverse-applicationsʙeveloping; skills in programming language Python; coding skills; cloud security skills. Hardware interconnection and programming: understanding of Internet communication and protocols; design and development of web pages/apps; API conceptualization and development; virtualization in cloud.

Content. Lab hardware (microcontrollers (ESP32, Arduino, Raspberry Pi Pico); single-board computers (Raspberry Pi); dedicated measurement systems (myDAQ)). Lab control software (LabVIEW; Python). Communication (serial communication; bus systems; HTTPS / REST; WebSockets). Web Apps (NodeJS; Docker; Svelte).

3.1.4 Mulsemedia

The purpose. The discipline “Mulsemedia” is aimed at presenting the basic ideas of the technology of Mulsemedia, including hardware for Mulsemedia content capturing and reproduction, Mulsemedia software, the standard for Mulsemedia content representation, applications of Mulsemedia, and other related topics.

Skills and competencies. It forms the following **competencies** and **skills**, including those indicated in D2.3: 3D modeling skills. Understanding computer vision. XR/AR skills for Training/Learning. VR in healthcare for therapists. Understanding Mulsemedia principles. Ability to use Mulsemedia technology in professional activities.

Content. Introduction to Mulsemedia concept. 2. Standard for Mulsemedia content representation. Mulsemedia hardware. Mulsemedia software. Application of Mulsemedia. The discipline “Mulsemedia” provides learners with the opportunity to understand basic principles, practical value, hardware, software, and possible applications of Mulsemedia.

3.1.5 3D/AR/VR modeling and communications

The purpose. This course is designed to provide students with a profound understanding and practical skills in 3D modeling, augmented reality (AR), and virtual reality (VR) within the sphere of digital communications. By delving into the intricacies of 3D/AR/VR technologies, students will learn to create immersive models and environments that facilitate effective communication and interaction in various professional and creative contexts. The course aims to foster a deep appreciation of the transformative potential of these technologies in enhancing interactive experiences, with a strong focus on user-centric design principles and innovative content creation. Furthermore, the course intends to broaden students' perspectives on the evolving landscape of digital media and its impact on future trends in communication, education, and entertainment sectors.

Skills and competencies. The acquired general skills based on Extended Reality (XR), Augmented Reality (AR) and 3D Visualization (D2.3) consist of computational design; 3D modeling; hardware and optics engineering; computer vision; image processing. List of special skills in Extended Reality (XR), Augmented Reality (AR), and 3D Visualization (D2.3): development of AR/VR Education Systems; AR Maintenance Technicians.

Content. Introduction to 3D Modeling for AR/VR. Advanced Techniques in 3D Animation. Immersive Environment Creation. 3D Asset Optimization for Real-Time Rendering. Cross-Platform AR/VR Development. Augmented Reality for Enhanced Communication. Integrating 3D Models with AR/VR Coding Frameworks.

3.1.6 Artificial intelligence tools and techniques

The purpose is to provide students with sufficient knowledge and skills in artificial intelligence tools and technologies.

Skills and competencies. Abstract thinking, analysis and synthesis. Ability to apply knowledge in practical situations. Ability to search, process and analyze information from various sources. Ability to make a reasoned decision.

Content. Introduction. AWS (AWS management console and how to use it; using AWS SIMPLE STORAGE SERVICE (S3); automating work with AWS resources using PYTHON; elements of ML in AWS SAGEMAKER; AWS Lambda). Scikit and Unsupervised Learning (metrics; clustering; anomaly detection; dimensionality reduction; tracking neural models; tensor board; weights and Biases; neptune). Model optimization (Auto ml; hyper opt; ray tune). Model deploying (docker; TorchServe deployment; fastAPI deployment).

3.1.7 Data science

3.1.7.1 Data mining

The purpose. The purpose of this course is to familiarize students with the concept of Data mining in Data Science, as well as the tasks and methods of Data mining that help to identify connections and patterns in Big Data, which can be used for forecasting and decision-making tasks.

Skills and competencies. According to D2.3: General skills (knowledge of AI-structure; a strong foundation in data science; AI-Ethics-skills). Special skills (AI-monitoring and forecasting the state of the IT market; AI-detection Web-contents for trends forecast).

Content. Functional and structural description of Data Mining technology. Formulation and solution of classification tasks (classification, clustering, pattern recognition), identification (structural, parametric, and structural-parametric), and forecasting. Formation of an array of input data. Models and their estimation. Intelligent monitoring technology. Practical implementation. Using Python (with Scikit-learn, NumPy, and Pandas libraries).

3.1.7.2 Machine learning

The purpose. The module objective is to familiarize students with the concept of Machine Learning in Data Science, the structure of Machine Learning, and Machine Learning methods and their application for solving various problems..

Skills and competencies. According to D2.3: Strong foundation in data science; using the machine learning

Content. Introduction to Machine Learning. Machine Learning as part of Data Science. Machine Learning Structure. Classical machine learning: learning with a teacher and without a teacher. Reinforcement learning. Tools of machine learning of models (neural networks; deep learning; genetic algorithms for training models; Group Method of Data Handling (GMDH); ensemble

methods of machine learning of models). Application of machine learning technologies in everyday life.

3.1.7.3 Statistical methods

The purpose. The course aims to provide students with the necessary knowledge and skills in the field of statistical data analysis.

Skills and competencies. To use statistical methods for the synthesis of regression models to solve business problems. Use statistical methods to assess the accuracy, adequacy and integrity of models built using machine learning algorithms.

Content. Least squares method. Analysis of time series. Statistical analysis of modeling results.

3.1.7.4 Databases

The purpose. The purpose of the «Databases» section is to study the design of relational databases, methods of preserving integrity and automating design according to their purpose, including selecting, adding, deleting, and updating data as simple work on tabular data, as well as combining, grouping, filtering, sorting as complex processing. The basics of the MySQL and PostgreSQL relational query languages are studied using the PgAdmin shell with further opportunities to connect both local and remote SQL databases through the Python SQLite library for data management and processing. The features of OLAP technology application for fast processing of large data sets in real-time are considered.

Skills and competencies. The list of **general skills** requested for jobs based on Artificial Intelligence (ability to collaborate with AI systems; development and integration of AI; AI-augmentation of skills). The list of **special skills** in Artificial Intelligence (AI-support to help customer support handle clients' requests; AI-support in generating content).

Content. The concept of a database system and components of a database management system. The relationship between relational model values and database elements. Manage relational databases with the MySQL query and report language. Features of creating Databases and data processing in PostgreSQL. Executing a group of queries using PostgreSQL. The concept of a data warehouse. Data warehouses that support Data Mining technology. OLAP technology as a tool for analyzing large amounts of data in real time.

3.1.7.5 Python

The purpose. The purpose of the module is to familiarize students with the means of software development, data presentation, and analysis in Data Science using Python and other instruments, including their application for solving various problems.

Skills and competencies. According to D2.3: general skills (AI-assisted tasks; using machine learning; development and integration of AI). Special skills (using TensorFlow and PyTorch; skills in programming language Python).

Content. The following topics are included: Python basics for working with Data Science; working with data arrays in Python. (NumPy); statistical data processing tools in Python. (Pandas); data visualization tools in Python (Matplotlib); machine learning tools (TensorFlow, PyTorch); tools for working with databases in Python (MySQL).

3.1.8 Human-computer and brain-computer interfaces

The purpose. The course aims to familiarize students with the new trends and development philosophy in the area of human-machine interface. The students are provided an overview of used technologies and technical backgrounds and learn to apply this general knowledge in the context of higher scholarly subjects.

Skills and competencies. Ability to collaborate with AI systems. Understanding of various Human-computer interfaces. Basic understanding of interface usage. Ability to determine the appropriate systems and apply them in professional activities

Content. Human-machine interactions and interfaces, including types, classes, and related terms. Communication ways and rules. Graphical user interface, rules for good interface design. Audio and visual interaction. Properties of audio/video signals, input/output devices and applications. Interfaces for the senses, such as touch, smell, and taste, as well as information about other related properties, devices, and applications Brain-computer interaction. Interface types and paradigms, devices, signal properties, applications. Virtual and mixed reality, input/output sensors, concepts, applications, technologies.

3.1.9 Digital twins

The purpose. The discipline “Digital Twins” is aimed at presenting the basic concepts of the technology of digital twins, including the advanced digital twins such as digital humans, digital twins based on the mulsemedia concept, digital twins based on artificial intelligence, etc.

Skills and competencies. It forms the following competencies and skills, including those indicated in D2.3: Ability to collaborate with AI systems. Understanding AI support in generating content. XR/AR skills for Training/Learning. Understanding Digital Twins. Ability to use Digital Twins technology and software in professional activities.

Content. Introduction to the Digital Twins concept. Digital Twins technology and software. Application of Digital Twins. Advanced Digital Twins. The discipline “Digital Twins” provides learners with the opportunity to understand basic principles, practical value, possible applications, and further advancement of Digital Twins.

3.1.10 Virtualization and cloud computing

The purpose. The Internet has come a long way from the first website to the versatile web applications that exist today. Applications, which used to be installed locally on a desktop computer are now available from within the web browser, like CAD tools, game engines and editors. This course is designed to provide students with a profound understanding of how complex web applications are developed, the role of individual technologies, as well as common tools and frameworks that aid in simplifying the development process.

Skills and competencies. Skills according to D2.3: programming skills for Metaverse-applications development; skills in programming language Python; coding Skills; cloud Security Skills and competencies. Competencies: understanding of Internet communication and protocols; design and development of web pages/apps; database modeling; API conceptualization and development; virtualization in cloud.

Content. Introduction to Web technologies (history of the Internet; Internet communication (OSI model, TCP/IP, UDP, Internet protocol v4/v6); Web architecture; application layer protocols (HTTP, TLS, URL); Web servers). Client-side web technologies (Frontend) (Web browsers, HTML, CSS, JavaScript and JSON, SVG, WebGL; server-side technologies (Backend) (PHP and relevant frameworks, NodeJS and relevant frameworks, Python and relevant frameworks). Databases (SQL, NoSQL, ORM). Authentication services APIs and Microservices (IoT). API protocols (REST, WebSocket, Webhooks). Virtualization (concept; Docker and Podman).

3.1.11 Mobile communications

The purpose. The module contains information about basic principles used in different generations of mobile networks. It describes the characteristics of different technologies implemented in the mobile networks (GSM, CSD, HSCSD, GPRS, EDGE, UMTS, LTE-(A), HSDPA, HSUPA, etc.).

Skills and competencies. All information within this module covers the 2nd, 3rd, and 4th generations of mobile systems, i.e. digital cellular systems. In the end of their learning, students are expected to understand the principles of mobile networks, specifically the functional organization of cellular networks and how their individual parts operate.

Content. Introduction (Radio Transmission Paths; Basic Classification of Radio Resources; Overview of technologies). Mobile Telecommunication Networks (introduction; cellular Mobile Telephone Networks; principle of sectorization; Access Methods; principle of automatic reconnection). GSM Mobile Network – mobile network of 2nd generation (Fundamentals of GSM system; GSM system and its standards; Services & Applications; Architecture of GSM Network; Structure and Functionality of Mobile Station; Mobile Terminal and its Connection to Base Station; Data Transmission in GSM Network and 2.5 Generation of Mobile Systems; CSD Data Transmission in GSM Network. HSCSD Data Transmission in GSM Network; GPRS Data Transmission in GSM Network; EDGE Data Transmission in GSM Network). Universal Mobile Telecommunication System (UMTS) (introduction; UMTS frequency allocation; WCDMA;

standardization and UMTS evolution; network architecture; HSDPA; HSUPA; services and QoS differentiation). Long Term Evolution (Advanced) - LTE(-A) (introduction; network architecture; LTE/LTE-A physical layer; beamforming; multiple antenna transmission; carrier aggregation; services and applications in LTE/LTE-A; femtocells; relays). Ad Hoc Networks (Ad Hoc Networks; MAC protocols; routing protocols; security; technologies enabling ad hoc). Wireless sensor networks; mesh network. Multipoint Distributive Systems (local Multipoint Distributive System (LMDS); multichannel Multipoint Distributive System (MMDS)). Location Based Services (location Based Services; satellite positioning systems; location by mobile networks). Future trends in mobile communications.

3.1.12 Blockchain

The purpose of the course is to provide a comprehensive introduction to Blockchain technology and its transformative potential. In this rapidly evolving digital era, blockchain has emerged as a revolutionary technology with implications across various industries, from finance and healthcare to supply chains and beyond. This course aims to demystify the complexities of blockchain, allowing course participants to grasp its fundamentals, applications, and impact on the global landscape.

Skills and competencies. The participants will acquire the following: an understanding of blockchain technology and its various applications; the ability to determine the suitability of blockchain technology for a certain use case/real-life problem; an understanding of various blockchain platforms and smart contracts. These skills and competencies are in line with what has been identified in D2.3.

Content. Introduction to Blockchain Technology. Blockchain Applications. Blockchain Platforms. Smart contracts. Blockchain and its integration with emerging technologies (e.g. AI).

3.1.13 Artificial intelligence for cybersecurity

The purpose of the course is to provide the students with knowledge, skills, and abilities (competencies) regarding the development and application of artificial intelligence methods in cyber security tasks. The objectives of the course for students are: to gain fundamental systematized knowledge about the approaches, models and methods developed in the framework of the "Artificial Intelligence"(AI) direction; to acquire the basic technologies of artificial intelligence by students; to develop students` analytical abilities that would allow them to choose AI models and methods when solving cyber security tasks.

Skills and competencies. Ability to use the acquired knowledge in practical scenarios. Ability to identify, define and solve professional problems. Knowledge of data search, data processing and data analysis. Ability to analyze, define and evaluate possible risks, vulnerabilities and other

destabilizing factors of digital environment and digital resources according to the established data security policy.

Content. Introduction. (what is Artificial Intelligence? What is Machine Learning? The Role of AI in Cyber Security). AI Techniques Used in Cyber Security. The Application of AI in Cyber Attacks (Attack Preparation; Attack Execution; Post-Attack Activities). The Application of AI in Cyber Defense (Attack Detection; Attack Mitigation; Security Operations. The Application of LLMs(Large Language Models) in Cybersecurity (Applications of LLMs in Attacks and Defense; risks of LLMs and Defense Measures.

3.1.14 Digital humanities

The purpose. The course aims to introduce students to digital data processing technologies in the humanities, for example, cultural studies, linguistics, and art, as well as to provide knowledge and skills in their structuring, visualization, and intellectual analysis.

Skills and competencies. digital literacy, licensing, using machine learning, and understanding privacy settings (following the points of the report D.2.3).

Content. History of the use of information technologies in the humanities. Problems of human-machine interaction. Legal scaling of digital data: Personal Data, Public Data, Open Data, Big Data. Creating Open Data: From HTML and XLS to CSV and XML. Metadata is data about data. Data Licensing. Analytics of visualized data. Geoinformation data visualization. Network analysis. Data Storytelling. Data visualization in the Orange Data Mining program (https://orangedatamining.com). Examples of machine learning in the tasks of data classification, regression analysis and cluster analysis of the description of humanities objects in the Orange Data Mining program. Pattern recognition (image, sound, human movements) in the Google Teachable Machine program (https://teachablemachine.withgoogle.com). Text Mining as intelligent text analysis in Voyant (https://voyant-tools.org/) and Orange Data Mining. Technologies of augmented reality in digital publishing. Creation of augmented reality information booklets in the ZapWorks program (https://zap.works/). Examples of mixed reality multimedia presentations based on the example of a regular Webcam and the PoseNet neural network. 9 Computer gamification of physical exercises in physical education and sports. Examples - https://youtu.be/yGdPbgSe7ak.

3.1.15 Natural activities and link with nature

The purpose. The course aims to acquaint students with the practical application of machine learning methods, involving geographic information systems for the analysis and processing of environmental information.

Skills and competencies. The practical application of machine learning methods for solving environmental tasks. Using GIS for data acquisition and analysis.

Content. Human impact on the environment in the Digital Age. General environmental information system. Use of digital technologies in environmental monitoring. Geographic information systems. Remote methods for obtaining environmental information. Machine learning methods for ecological information analysis. Practical section (obtaining environmental data from satellite images (Basics of GIS operation); determination of vegetative and other indices (GIS and with the help of Python); forest monitoring (utilizing classification in GIS); monitoring of surface waters and oceans (using GIS in retrospective analysis); prediction of environmental parameters (Machine learning tools); Methods of visualizing environmental information using GIS and Python libraries.

3.2 Soft Skills And Digital Ethics

3.2.1 Digital communication and collaboration

The purpose of this course is to teach students advanced skills and strategies in digital communication and collaboration, utilizing the transformative 3E framework: Enhance, Extend, and Empower. In an era where effective communication and collaboration are integral to success, this course aims to elevate participants' abilities to navigate, lead, and innovate in the digital landscape.

Skills and competencies. Understanding of 3E Framework Enhance, Extend, and Empower; understanding of basic collaboration and communication tools like Teams, Zoom, Google meet Special skills (knowledge in project management tools like Jira, Asana, Trello; knowledge in collaborative platforms like Miro or Figma).

Content. Enhance (advanced Communication Tools: Dive into platforms like Slack, Microsoft Teams, or Discord, emphasizing features that enhance collaboration and communication; digital Etiquette Training: provide guidelines for effective digital communication etiquette, covering email, messaging, and video conferencing); virtual Presence Training: Use tools like Zoom or Google Meet to simulate virtual meetings, focusing on techniques to enhance one's presence in a digital environment). Extend. (AI-Powered Collaboration Tools: Explore tools like Grammarly for writing enhancement, or project management tools with AI features, such as Asana or Trello; collaborative Platforms: Introduce advanced features of collaborative platforms like Miro or Figma for virtual whiteboarding, brainstorming, and project planning; Immersive Technologies: Experiment with virtual and augmented reality tools for collaborative experiences, like Spatial or AltspaceVR). Empower (leadership in Digital Communication: Provide case studies on successful digital leaders, discussing their strategies and approaches to fostering effective communication in a digital environment; virtual Team Management Tools: Explore tools like Monday.com or Jira for managing virtual teams, emphasizing features that facilitate task delegation, progress tracking, and team collaboration; inclusive Communication Workshops: Conduct workshops on promoting diversity and inclusivity in digital communication, using tools like Mentimeter for interactive discussions or Slido for anonymous Q&A sessions. General Tools for throughout the Course (Communication Analytics Tools: Introduce tools like Google Analytics or Microsoft Workplace Analytics to help participants measure the effectiveness of their digital communication strategies; collaborative

Document Editing: Incorporate tools like Google Docs or Microsoft 365 for real-time collaborative document editing, reinforcing the importance of seamless collaboration; Project-Based Learning Platforms: Platforms like GitHub, GitLab, or Bitbucket can be utilized for collaborative coding projects, emphasizing version control and collaborative coding practices).

3.2.2 Digital teamwork and leadership

The purpose. The purpose of the course is to provide students with the necessary knowledge and skills to obtain competencies following the topic "Other technologies relevant to the next-generation digital job market" (described in D.2.3) regarding the creation and use of digital teamwork approaches and the implementation of team management and leadership processes through them.

Skills and competencies. Following report D2.3, the following course competencies are defined: Leadership; Teamwork; Communication Skills; Collaboration; Remote collaboration proficiency; Flexibility; Transparency; Accountability; Self-Management; Time Management; cybersecurity awareness.

Content. The following course outline is provided: Introduction (Definition of digital teamwork and leadership; importance of effective team management and leadership processes). Digital Teamwork Approaches (collaborative tools and platforms; virtual meetings and communication channels; cloud-based document sharing and collaboration; integration of personal digital devices; basic knowledge of cyber security and data protection. Implementation of teamwork and leadership processes (setting clear goals and expectations; building transparency and accountability; facilitating collaboration and decision-making; empowering team members; providing digital support and guidance). Case studies or examples (successful implementation of digital teamwork approaches; challenges faced and lessons learned; impact on team performance and productivity). Conclusion (recap of key points; the importance of leveraging digital teamwork approaches for effective team management and leadership. future implications and recommendations for further research or application.

3.2.3 Digital ethics

The purpose of this course is to familiarize students with the moral and ethical standards of behavior in the digital environment for all subjects of the information society; providing students with the knowledge and skills necessary to navigate the complex ethical landscape of the digital world, to form a high culture of landscape of the digital world, the formation of a high culture of communication and effective business interaction.

Skills and competencies. Following report D2.3, the following course **competencies** are defined: AI-Ethics-skills; communication; empathy; work ethics; honesty; balancing digital and face-to-face interaction; courage to oppose unethical practices; ethical awareness; ethical decision-making; etiquette; respecting privacy in digital communication.

Content. Basic principles, standards and norms of digital ethics (Ethics as a doctrine of morality. Moral norms and principles. Ethical understanding of information and communication processes; basic principles of digital ethics: confidentiality, privacy, security, equality of access to information, responsible use of technology, etc.; norms and rules of behavior in the interactive digital space. Digital etiquette). Moral and ethical aspects of the use of artificial intelligence, data collection, processing and use (ethical principles of artificial intelligence application, such as transparency, fairness, accountability and confidentiality; the impact of artificial intelligence on society (social consequences of the use of artificial intelligence; moral and ethical aspects of the use of artificial intelligence); ethical aspects of data collection, processing and use). Ethics of virtual communication (ethical understanding of virtuality and the formation of ethics of virtual communication; moral principles of virtual communication: freedom of speech, openness, tolerance, equality of parties, politeness. Multicultural communication in cyberspace and its moral and ethical component.

3.2.4 Transversality and integrity

The purpose. The discipline “Transversality and Integrity” is necessary for forming a deep understanding of interconnections and interactions in various fields of knowledge in the conditions of a digital environment. Focusing on transversal aspects, learners will study the principles and methods of solving complex tasks that cover various scientific and practical fields that can be applied in a digital environment. The discipline promotes the development of analytical and critical skills necessary for an integrated approach to solving modern problems that require interaction of different fields of knowledge and joint work in interdisciplinary teams, including in a digital environment.

Skills and competencies. It forms **competencies** that are necessary for society to know and can be applied in different situations and contexts: **transdisciplinary skills (**ability to apply knowledge and methods of different scientific fields to solve complex tasks and problems that require an integrated approach; ability to work in interdisciplinary and intercultural teams, taking into account different opinions and interests. **Integrity of thinking (**ability to see the big picture and understand interconnections and the impact of different factors on specific situations). **Communication skills (**ability to communicate effectively and exchange ideas with representatives of different fields of knowledge, emphasizing comprehensibility and mutual understanding). **Critical, analytical and creative thinking (**ability to analyze information, identify key aspects of problems and formulate reasoned decisions, ability to analyze and synthesize information from different sources and fields of knowledge; ability for reflection and self-assessment). **Problem-solving ability (**formation of practical skills in solving complex tasks that require a combination of different disciplinary approaches). **Readiness for continuous learning and development** in the conditions of a dynamic world and in uncertain conditions. **Awareness of one’s social responsibility and ethical principles,** ability to adapt to changes and new conditions.

Content. Transdisciplinarity (understanding and applying concepts that go beyond traditional scientific fields, to solve complex tasks and challenges generated by information technologies and the digital environment). **Interaction of Knowledge** (studying the mechanisms of interaction

between different branches of science, technology, art, and social sciences to achieve integrated solutions in different dimensions of reality, including digital, virtual and augmented). **Integrity of Systems:** Analysis and understanding of interconnections in complex systems, which include the digital environment, as well as the development of strategies to ensure their integrity and stability. The discipline “Transversality and Integrity” provides learners with the opportunity to develop flexible thinking and a creative approach to solving modern problems. This discipline is designed to contribute to the formation of a deep understanding and flexibility in the use of knowledge in various situations, preparing them for the challenges of the modern world, where integration and interaction play an important role.

3.2.5 Developing intercultural competencies and soft skills through transmedia co-creation

The purpose. The course is aimed at deepening understanding and knowledge of various linguistic cultures, efficiently communicating in various digital environments with the representatives of different cultures applying various tools and strategies, as well as learning rules of international etiquette and communicative behavioral patterns, thus demonstrating a high level of intercultural communicative competence in a digital intercultural environment. The course is focused on the typological characteristics of cultures, linguocultural types, intercultural communication styles, and the standard communicative behavioral patterns in situations of cross-cultural interaction. The specificity of intercultural project activity and application of the digital tools in the international project activity as well as the projects aimed at collaborative online learning will be considered.

Skills and competencies. Upon finishing the course, the students will be able: to improve their communicative and intercultural competencies of the students; to evaluate and critically assess social, personal, and professional problems in situations of digital intercultural communication and efficiently solve them; to find the optimal ways for efficient professional and project cooperation and teamwork with the representatives of different cultures in the digital environments; to efficiently apply expressive, emotional, logical, and other linguistic tools to achieve the desired pragmatic effect and organization of successful intercultural communication and cooperation in various digital environments; to preserve the norms of international etiquette and understand the behavioral patterns of the representatives of various linguistic cultures to develop linguocreative thinking to realize communicative strategies in unusual situations of cross-cultural interactions.

Content. Part 1. Intercultural communication in the digital world (types of cultures, and the influence of culture on communicative behavior. Linguistic cultures and their specificity (communicative behavioral patterns of the representatives of different cultures; culture universals. Dialogue of cultures. Ethnic tolerance. Stereotypes; identity. Cultural values. Perception of time and space in various linguistic cultures; G.Hoefstede and E.T.Hall studies as the tools for comparison of cultures). **Part 2. Linguocultural types and their linguistic behavior** (linguocultural types; intercultural differences in verbal and non-verbal behavior; intercultural styles of communication; linguistic and cultural shock: stages; transmedia storytelling as an

efficient tool for the description of linguocultural types). **Part 3. Intercultural project activity in the digital environment** (intercultural communication in the digital environment as an efficient tool for the preparation of the project;- Standard project charter; project preparation in the digital environment; specificity of Intercultural business and professional communication; Web quests for efficient cooperation. Cross-cultural digital training).

3.3 Mental health awareness

3.3.1 Mental well-being in terms of digitalization

The purpose. The purpose of this course is to develop students' ideas about the positive and negative impact of digitalization on human life and health, in particular about the conditions and possibilities of maintaining mental health in the digital environment.

Skills and competencies. Self-awareness and self-esteem; emotional self-regulation (self-control), assertiveness, creativity.

Content. The discipline involves the study of terminology from the course, and how it can be applied in the formulation of the student's own opinion regarding the main aspects of the course: the impact of digitization on human life; controlled use of digital technologies (setting limits to protect against stress and overload); responsible attitude to the use of social networks; practical aspects of digital detox, reboot methods, technologies to promote mental health (meditative techniques, sleep trackers, meditation apps); flexibility and adaptation to constant changes in the digital world. The practical block of the course involves teaching students to use interactive exercises and group dynamics to stimulate the formation of their own opinions, discussions, and exchange of experiences; understanding and evaluating new technologies that may affect their mental health.

3.3.2 Holistic vision

The purpose. The purpose of the course is to provide a well-rounded approach to personal and professional fulfillment. In today's digital and ever-evolving world, success is not merely about acquiring specific skills but involves cultivating a holistic perspective that encompasses personal growth, professional development, and lifelong learning. Through a combination of interactive sessions, case studies, and practical exercises, participants will gain the tools and insights needed to navigate the complexities of the modern workplace, fostering a holistic vision for sustained success and personal fulfillment.

Skills and Competencies. Explore techniques for self-reflection to uncover personal strengths, values, and passions. Define and refine individual goals and aspirations to create a roadmap for a fulfilling career; embrace a mindset of continuous adaptation to stay relevant in a rapidly evolving job market; develop a strategic mindset for career planning, considering both short-term and long-term objectives; understand the importance of adaptability and resilience in the face of

evolving career landscapes; enhance cross-cultural communication skills for effective collaboration in multicultural environments. These cover the top needed 'soft skills' identified in our skills analysis gap presented in D2.3.

Content. Self-discovery and purpose, Strategic career planning. Continuous adaptation and Lifelong learning. What is emotional intelligence and how to cultivate it? Effective communication and networking. Multicultural environments.

3.3.3 Responses to special educational needs

The purpose. The course introduces students to computer technologies of human-machine interaction for people with permanent physical impairments (vision, hearing, speech, and musculoskeletal disorders) and is meant to provide them with knowledge and skills in creating prototypes of educational computer games using human gesture recognition software libraries, human voice, and text.

Skills and competencies include online communication skills during the education process, creativity, physical activity and applying machine learning (following the points of the report D.2.3)

Content. Basic types of human actions/sensations and the use of human-machine interaction computer interfaces by people with persistent physical impairments, such as visual, hearing, speech and musculoskeletal impairments. Basics of computer game design: game plot, game mechanics/dynamics/aesthetics, game multimedia content (graphics, sound). Design of educational games and adaptation of game design to the education of people with persistent physical disabilities. Block visual programming in the Scratch environment and rapid prototyping of computer games. Human gestural interface in the Scratch environment based on the Webcam and the PoseNet neural network (https://github.com/champierre/posenet2scratch). Images of real-world objects in educational computer games based on the Google Teachable Machine Web Camera and neural network https://teachablemachine.withgoogle.com . Sound and voice interface in educational computer games.

3.4 Law aspects in digital environments

3.4.1 Personal data protection

The purpose. The goal of the discipline is to teach students to analyze information protection systems, choose a cryptographic algorithm in the device settings according to the formulated task, and perform successful debugging of software for cryptographic protection.

Skills and competencies following report D.2.3: Cybersecurity awareness, Communication, Critical thinking, Understanding privacy settings, Adaptability.

Content. Introduction to privacy protection. General Data Protection Regulation. Privacy laws, regulations and public policy. Foundational concepts of information security and privacy exploring

information value. Classifications of threats to personal data. Digital footprint: definition, examples, and ways to reduce. Recommendation of privacy and security settings for software applications. Biometrics as data security. Technical aspects of information protection. Classification of cryptographic systems. Encryption key. Fields of application of cryptography. User identification. Password storage methods. Examples of simplest ciphers: Caesar's Cipher and Generalized Caesar Cipher. The importance of prime numbers in information security. Symmetric and asymmetric systems of cryptographic protection of information. Features of their use. Key exchange according to the Diffie-Hellman scheme and the RSA algorithm. The AES and its features (correct settings in applications). NIST competition. Requirements for the new algorithm. A system for checking the implementation of the algorithm for compliance with the standard. Digital Signature Standard (DSS) and El-Gamal scheme in digital signature mode.

3.4.2 Legal aspects of digital contracts

The purpose. The course aims to develop knowledge of legal framework for digital contracts. Is digital contracts capable of replacing traditional contracts? Students will get an introduction to the legal issues of contract law, limitations and risks, and case law on digital contracts. They will learn about the legal issues of digital contracts in various industries: gaming, gig contracts, employment contracts, sales and services, and intellectual property protection. This course also helps to develop soft skills in analyzing and resolving legal issues in the field of modern technologies. The knowledge gained will increase the competitiveness of graduates in the new labor market in the digital age. Students will be able to manage the legal aspects of digital contracts in a rapidly changing digital environment.

Skills and competencies following report D.2.3: multidisciplinary perspective, Problem-Solving Skills, Digital Literacy, Legal and Ethical Awareness, Awareness of the ethical impact, Balancing digital and face-to-face interaction, The ability to get along with people and negotiate, Respecting privacy in digital communication, Appropriate use of language and tone, Responsibility, Courage to oppose unethical practices, Prioritisation and planning, Collaboration. **Special soft skills**. Analyze digital contracts in various practical areas; determine the terms of the contract to automatically enforce certain provisions; understand the legal nature, risks and fines for breach of digital contracts; manage legal risks in digital contracts; apply the law to resolve conflicts in digital agreements;

Content: General provisions on contracts. Basic concepts and categories of contract law. Digital contract: law or source code? Legislation framework. Legal regulation of e-commerce, digital transactions, digital signatures (digital and virtual property - a legal overview for digital contracts; legal regulation of digital contracts: prospects and risks of use; comparative legal study of traditional and digital contracts; features of personal data protection in digital contracts. legal and ethical issues of using digital contracts in various fields. judicial practice of disputes in the field of digital contracts.

3.4.3 Intellectual property in the digital age

The purpose. The purpose of the discipline is to help students in the acquisition of competencies in using digital technologies for explorative research, in particular, patent information search and the peculiarities of protecting digital technologies as objects of intellectual property rights.

Skills and competencies. in Report - AI-Ethics-skills, Critical Thinking, Creative Problem-Solving, Licencing, Analytical thinking

Content. Digital technologies as objects of intellectual property rights. Features and types of free licenses: what you need to know when publishing your own works and using works of others. Patent databases: preparing a search query, peculiarities of using databases, determining the competitive environment and regions of innovation activity following the search query. Features of computer program protection, peculiarities of intellectual property rights to the results obtained through using artificial intelligence. Features of protection of digital technologies as objects of patent law. Standard basic patents in the digital age. Protection of the goods producers' rights in the digital age. E-commerce.

4 Conclusions

The recommendations are developed with the understanding that the teaching materials should be comprehensible to students who do not have IT knowledge, so it is necessary to provide as detailed and concise an explanation of existing digital tools and processes as possible. At the same time, the development of communication skills, ethical norms, understanding of mental health preservation methods and legal attributes used to regulate relations between developers in a professional environment should not be neglected in the process of acquiring skills for the correct use of digital tools. The above recommendations will be implemented during the development of training courses within the framework of the work package WP3.

5 References

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[3] NEXT – Digital Transformations for Supporting Next-Generation Labour. Deliverable 2.2.Report on questionnaires of stakeholders. https://ec.europa.eu/research/participants/grants/101129022;jsessionid=wvrqjBnqFDoxzAxQBcpACsg4Fb967qmtK3ksOIDXFxjUE4fkuSBZ!1994326490?ticket=ST-8997951-SoumCF6HQ6IzHlmjKvLMjYiUgQEmKkdlssu7B4f0BDuxLp36zy6y9t4yEAxlgZXrOIVRlPuaC3o5Jg4kfuUt

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