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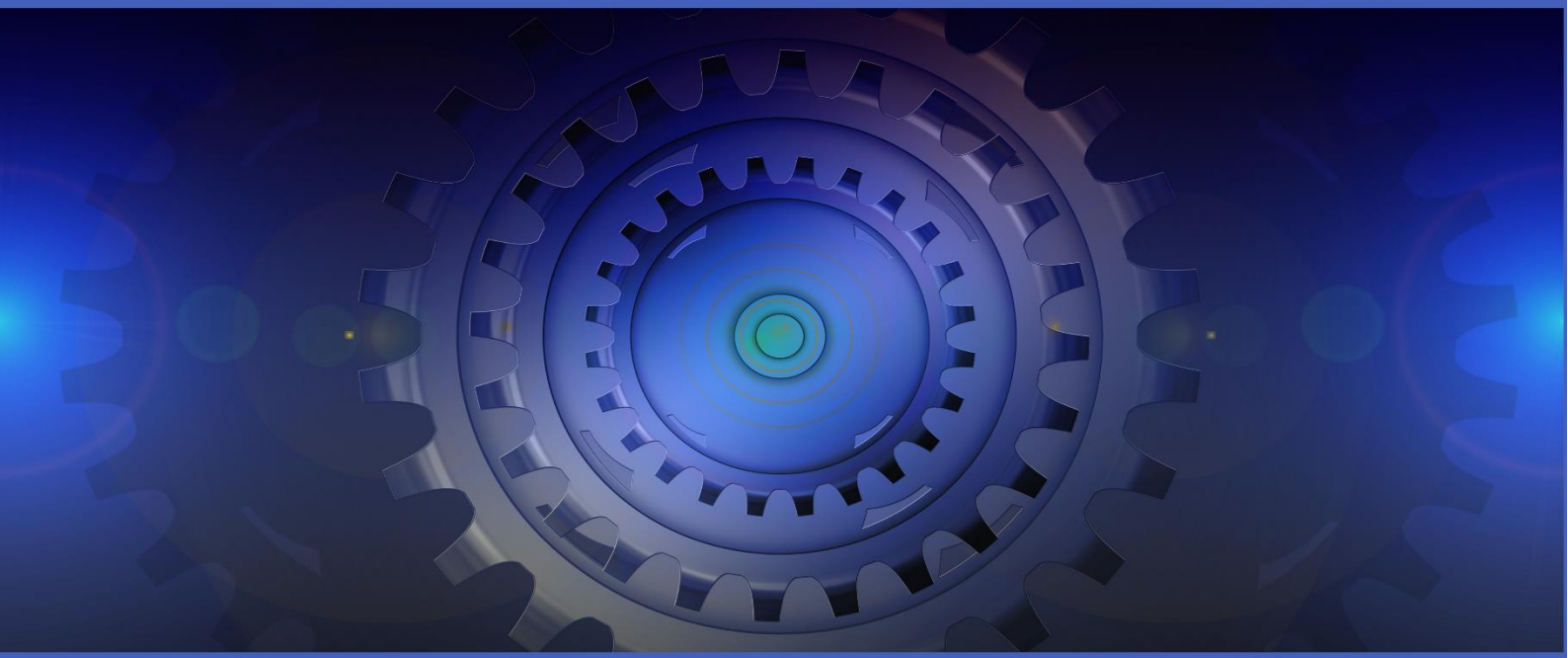
ASSISTANT - Challenge Based Learning in Ai Enhanced Digital Transformation Curricular
No. 2022-1-LT01-KA220-HED-000086555

DIGITAL TRANSFORMATION CURRICULAR



https://www.assistant-erasmus.eu/

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DIGITAL TRANSFORMATION CURRICULAR

(PR1/A2)

FOR **PR1 – DIGITAL TRANSFORMATION CURRICULAR**

T2.2. Identification of DT curricular - the aim of the task is to identify the DT curricular and to design the content according to open open education conception.

ASSISTANT, 2022

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CONTENTS

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1.INTRODUCTION

The aim of the document is to describe Digital transformation curricular. Moreover, the aim is directly related to the ASSISTANT project objectives, that are: (1) to increase the number of courses on Digital transformation curricular, (2) to increase of using intelligence technologies in education by developing virtual assistant, (3) to increase HE learners' experience on digital transformation settings supported with catboats, (4) to increase awareness on benefits and implementation practices.

Digital technologies are bringing about unprecedented change to business models, products, and services, transforming how people work and interact with customers, partners, and competitors. The resulting digital transformation (DT) is not a recent trend but an ongoing paradigm leading to a digital change of society and economy at all levels. For the individual organization, DT can be regarded as a process, which comprises incremental and disruptive changes enabled by digital technology. Digital transformation is a learning process that requires integrating technology (Big data, Digital twins, Artificial intelligence, Robotics), business and learning strategies (CBL) in an entrepreneurial-oriented organization. To understand such technology driven transformation processes Fountain's technology enactment framework differentiates between objective and enacted technologies. Objective technology incorporates innovations such as analytics or the Internet, whereas enacted technology entails the use, design, and perception of those technologies by individuals within the organization. The role of technology, therefore, is dependent on the organization and what individuals within the organization make out of it (Gudoniene et al. 2020). However, we need to prepare the DT curricula at the universities according to the needs of business and industry. There are also three main aspects why we need the project: 1) first is related directly to the need of business and industry organizations on digital transformation curricular, the increased number of the topics what nowadays organizations need to know for their successful business process: i.e. Big data, Digital education, Artificial intelligence, Robotics technologies need to be included to the study programs or for life long learners fully online. 2) Teachers need AI technologies to assure successful contribution to the support of the learning process. During the pandemic increased requests of support to get new skills and knowledge by support in the individual way. For this can help AI technology based digital assistants (chatbots) prepared/trained to assist in the requested digital transformation field. 3) To get the added value to learners by involving business organization to the challenges solving we need to develop CBL scenarios that will contribute directly to the digital transformation field. Our project is focusing on the EU Digital principles strategy declaring that Everyone should have access to technology, which should be inclusive, and promote our rights. Committed to: (1) making sure that technological solutions respect people's rights, enable their exercise and promote inclusion; (2) a digital transformation that leaves nobody behind. Moreover we are planning to develop not only digital transformation curricula but digital assistance technologies based on Artificial intelligence solutions to support the learning process.

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2. DESCRIPTION OF THE TRAINING PROGRAM

Digital transformation is a learning process that requires integrating technology, business and learning strategies (CBL) in an entrepreneurial-oriented organization. To understand such technology driven transformation processes Fountain's technology enactment framework differentiates between objective and enacted technologies. Objective technology incorporates innovations such as analytics or the Internet, whereas enacted technology entails the use, design, and perception of those technologies by individuals within the organization. The role of technology, therefore, is dependent on the organization and what individuals within the organization make out of it (Gudoniene et al. 2020).

However, we need to prepare the DT curricula at the universities according to the needs of business and industry. There are also three main aspects why we need DT: 1) first is related directly to the need of business and industry organizations on digital transformation curricular, the increased number of the topics what nowadays organizations need to know for their successful business process: i.e. : (1) Big data, (2) Digital education, (3) Artificial intelligence, (4) Robotics and IoT) digital resource (totally 4 open online courses) need to be included to the study programs or for life long learners fully online. 2) Teachers need AI technologies to assure successful contribution to the support of the learning process. During pandemic increased request of support to get new skills and knowledge by support in the individual way. For this can help AI technology based digital assistants (chatbots) prepared/trained to assist in the requested digital transformation field. 3) To get the added value to learners by involving business organization to the challenges solving we need to develop CBL scenarios that will contribute directly to the digital transformation field.

Aim of the training program	1) to increase number of courses in the HE curricular required for business and industry on DT by design and development Digital transformation curricular courses: (1) Big data, (2) Digital education, (3) Artificial intelligence, (4) Robotics and IoT) 2) to assure the new skills for learners of HE and wider communities outside 3) to focus on the quality of HE curricular by assuring the quality of the PR1
Objectives of the general program	1) to increase number of courses in the HE curricular required for business and industry on DT by design and development Digital transformation curricular courses: (1) Big data, (2) Digital education, (3) Artificial intelligence, (4) Robotics and IoT) 2) to assure the new skills for learners of HE and wider communities outside 3) to focus on the quality of HE curricular by assuring the quality of the PR1
Target group	DT courses participants: students and non formal learners from business and industry, 20 per partner, totally 80 in the project TPM 1 - 2 persons per organizations will participate.

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Prerequisites	Basics in IT
ECTS or Hours	160 h.
Duration	16 weeks
Languages	EN, LT, PT, DE, EE
Link to the website	https://www.assistant-erasmus.eu/
Creators	

2.1.Structure/Framework (online courses)

The training programme is based on the CBL and MOOCs methodology

Title/topic	Study programme module	Duration	Coordinator (Institution)	Authors
Big data	Data analytics and visualization	2 ECTS/h	KTU	Evaldas Vaičiukynas, Lina Čeponienė, Rita Butkienė
Digital education	Digital education	2 ECTS/h	TU	Sirje Virkus, Sigrid Mandre, Veronika Rogalevits
Artificial intelligence	Artificial intelligence	2 ECTS/h	UAb	José Coelho, Vitor Rocio, Henrique São Mamede
Robotics and IoT	Digital Innovation Lab	2 ECTS/h	FHM	Jochen Dickel, Olga Zubikova

2.2.Teaching and learning methods

General strategy, activities, challenge based, Chabot support. Materials for each module will be available online https://www.assistant-erasmus.eu/ Format of the learning material is intended: Text File, Website, videos (according to the MOOC methodology).

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MOOCs (Massive Open Online Courses) have become one of the fastest growing market in the field of education. More and more new European institutions get involved in it every year. The entrance of new players in the market of MOOCs has fostered new winds regarding the provision of MOOCs. Every year, new ideas, approaches, methods, strategies and tools are applied in order to facilitate the process of MOOCs provision thus making MOOCs more innovative, unique, and attractive for learners. To stay competitive in the fast-growing market, institutions have created their own MOOCs provision strategies. The rapid change of market players and the growing supply shapes a new understanding of MOOCs. For this reason, organizations have to rethink their strategies for MOOCs provision more often and redesign their plans to stay up-to-date. The paper aims at presentation and comparison of the most popular institutional strategies concerning MOOCs provision[1].

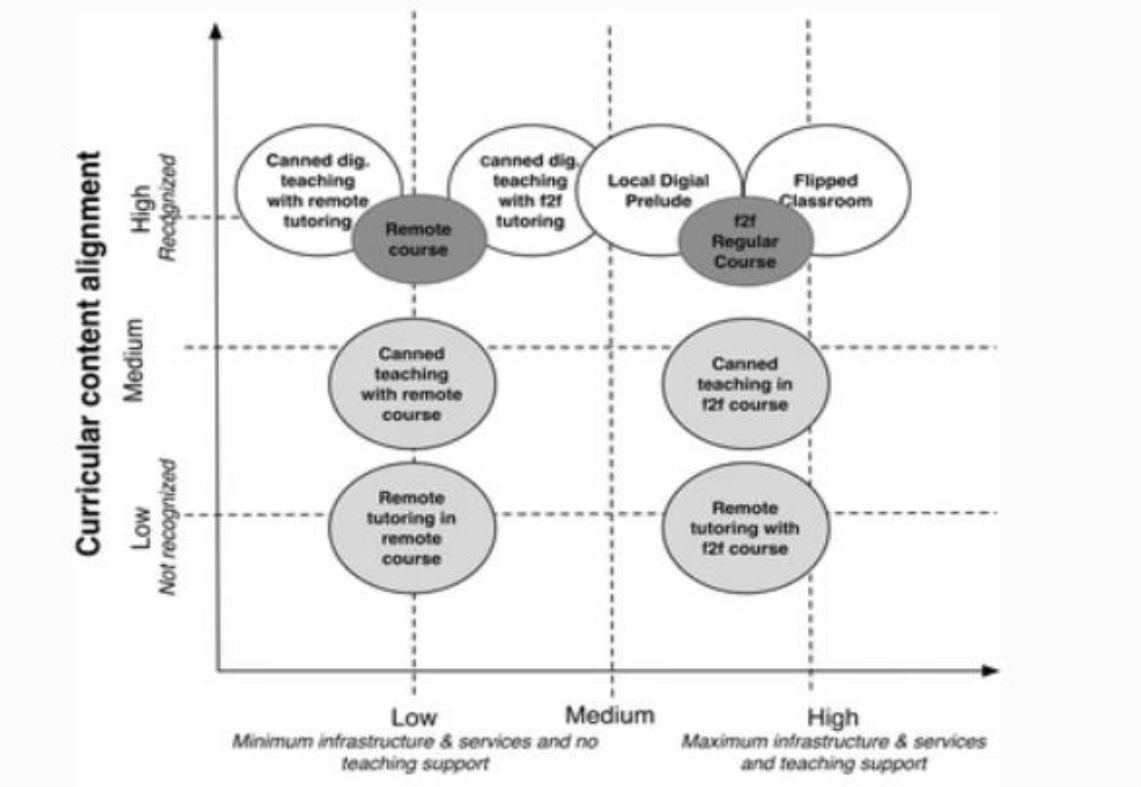

Fig. 1. Hybrid MOOC-based models from the literature organized according to the H-MOOC framework: in dark gray *two example non-hybrid MOOC-based models, in white those models that integrate online components, and in* light gray *hybridized remote courses*[2]

The next important aspect of the ASSISTANT is using CBL - challenge based learning in the Digital transformation curricular.

[1] Abstract View (iated.org)
[2] H-MOOC framework: reusing MOOCs for hybrid education | SpringerLink

There are various definitions of CBL in the scientific literature [9]. Analysis of scientific literature3 shows that CBL draws from different educational theories and pedagogical methods, for example, problem-based learning and inquiry-based learning (IBL). Problem-based learning has been widely adopted in medicine and engineering education, due to the expected benefits in improving student critical thinking, self-directed learning, generic skills, and long-term retention [10, 17]. The CBL method can be described as a special form of problem-based learning (PBL), in which the problems are of realistic, open-ended nature. Additionally, the CBL contains features of experiential and project-based learning approaches.

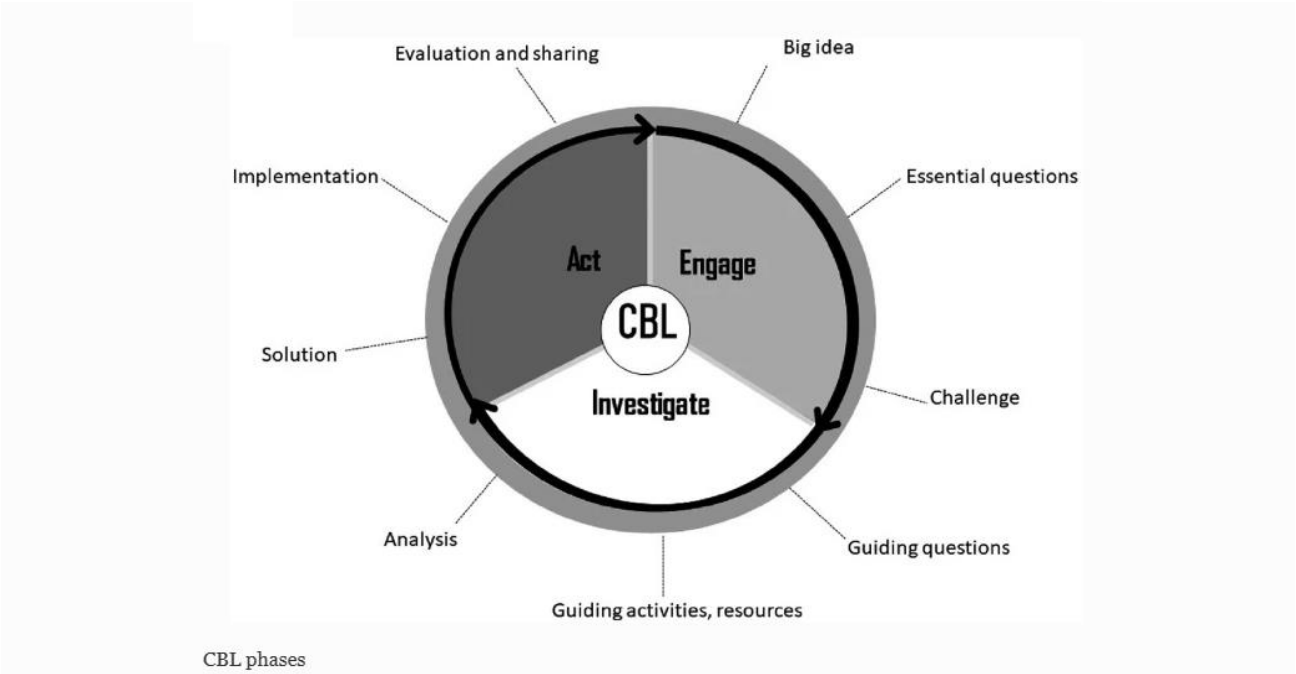

Fig. 2 CBL- challenge based learning phases.

The authors [8] declare that CBL is a multidisciplinary approach that encourages students to actively work with peers, teachers and stakeholders in society to identify complex challenges, formulate relevant questions, and act for sustainable development. This method is a student-oriented learning approach that empowers them to solve complex challenges which appear in the real world. In addition, this method encourages students to collaborate in interdisciplinary and intercultural teams, work with peers, teachers, and experts in their communities, and promotes self-directed learning both inside and outside the classroom [7, 9]. CBL focuses on the real world and surfaces the essential relevance of the core subjects at the same time [7]. In this paper, it is argued that CBL

[3] Technology-Enriched Challenge-Based Learning for Responsible Education | SpringerLink

can be viewed as an evolution of the Concept of Conception, Design, Implementation, and Operation (CDIO), expanding, as well as deepening, the learning experience[4].

2.3. Methods of assessment of learning achievements

Methods of learning outcomes verification can be used differently in the designed modules: (1) Summative, (2) Formative, (3) Mixed.

Types of assessment to be used in the training programme: (1) Questions for self-assessment; (2) Test; (3) Project; (4) Practical assignment.

2.4. Targets

TEACHERS AND TRAINERS: they will have a deeper understanding of the innovative techniques of MOOCs development and delivery, and of supporting strategies for teaching staff and students in digital transformation curricula via MOOCs. They will acquire these additional digital competences that will contribute to their professional development, and therefore significantly upgrade their qualifications that will be recognized at their home institutions.

SME REPRESENTATIVES: they will get free opportunities for their professional development on digital transformation curricular and for taking responsibility for their professional growth. Their skills on digital transformation will be boosted, and this will lead to increased quality of educational services and to better learning experiences of their students.

HEI STUDENTS: the motivation of students to learn and their satisfaction with Digital transformation innovative curricula is expected to grow through designing engaging learning environments. Due to offering open learning formats, their self-directed learning competence and digital competence in general will be boosted. In addition, their social competence and competence to collaborate in virtual environments by respecting each other will grow. All these competences are becoming increasingly relevant for the labour market, therefore students will be better prepared for their future career.

NON-FORMAL LEARNERS: they will get new skills on digital transformation and a wider access to HEI services through the developed MOOCs and upgrade their qualifications for free. Similar to HEI learners, their transversal competences such as learning, digital and social competences will grow. Thus, their chances on labour markets will be significantly increased.

[4] Technology-Enriched Challenge-Based Learning for Responsible Education | SpringerLink

3. DESCRIPTION OF THE COURSES/MODULES

The training programme is constructed out of 4 modules with a minimum hours per each course.

3.1. Online Course "Big data"

3.1.1. Summary/annotation

Information technologies with growing amounts of digital storage and more devices or sensors than ever before have resulted in massive quantities of diverse data, where applying this data for many useful purposes becomes challenging. Term Big Data indicates massive and often unstructured data, for which traditional data management and analysis tools are insufficient.

The aim of the course is to give an an overview of the Big Data concept and main techniques for working with it effectively. Practical focus is on extracting value and formulating data-driven insights using analytics and visualization. By the end of the course, students should have a sufficient knowledge of big data analytics as a tool for addressing research questions and approaching challenging problems with data-driven solutions.

Keywords: big data, ETL, parallel computing, R programming, forecasting, dashboards

3.1.2. Learning Outcomes

On successful completion of this course, graduates will be able to:

1. define main properties of big data and identify when data at hand needs big data tools;
2. select proper storage and analytic tools for building big data processing pipelines;
3. collect large amounts of data using public APIs or web scraping techniques;
4. process data using custom parallelized solution with R programming language;
5. prepare time-series data and perform anomaly detection or forecasting tasks;
6. design a custom dashboard by choosing from a set of common visualizations.

3.1.3. Syllabus/Topics

Topic 1. Fundamentals of big data analytics

Topic 2. Main big data tools: Hadoop, Spark, H2O, etc.

Topic 3. Data harvesting: APIs and web scraping

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Topic 4. Parallel processing with R programming

Topic 5. Time-series analysis and forecasting

Topic 6. Low-code framework Dash for visuals

3.1.4. Lessons

Topic 1. Fundamentals of big data analytics

- Lesson 1.1 Big data: definition and taxonomy
- Lesson 1.2 Hadoop and distributed computing
- Lesson 1.3 Example use-cases from industry

Topic 2. Main big data tools: Hadoop, Spark, H2O, etc.

- Lesson 2.1 Efficient HDFS storage and MapReduce jobs
- Lesson 2.2 Spark for ETL and large-scale data processing
- Lesson 2.3 Predictive analytics tasks using Spark and H2O

Topic 3. Data harvesting: APIs and web scraping

- Lesson 3.1 Probing public APIs with Postman tool
- Lesson 3.2 Using APIs for collecting data
- Lesson 3.3 Basics of web scraping

Topic 4. Parallel processing with R programming

- Lesson 4.1 Simple solutions with R package pbapply
- Lesson 4.2 Advanced pipelines using R package targets

Topic 5. Time-series analysis and forecasting

- Lesson 5.1 Aggregating high-frequency time-series
- Lesson 5.2 Detecting anomalies in time-series data
- Lesson 5.3 Forecasting of time-series data

Topic 6. Low-code framework Dash for visuals

- Lesson 6.1 Introduction to Dash framework
- Lesson 6.2 Visualizations for dashboard design
- Lesson 6.3 Bringing data app into production

3.1.5. Assessment criteria

Outcome – Activity - Criteria

Final grade (10-point scale) composition:

- 60% - Moodle test from learned topics with certainty-based marking;
- 40% - peer evaluation of practical micro-challenge data-driven solution.

3.1.6. References

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3.2.Online Course “Digital Education”

3.2.1. General

The aim:

The aim of this course is to provide students with a comprehensive understanding of digital education and its various components. The course aims to introduce students to the benefits and challenges of digital education and various learning theories that apply to digital education. It provides students with an understanding of online learning strategies and pedagogical approaches for online teaching. The course also aims to explore the various digital tools used for digital education. In addition, the course aims to teach students about instructional design principles for digital education, multimedia content creation, and adaptive learning design. It focuses on assessing and evaluating online learning programs using different types of assessments, rubrics, and open digital badges. The course also highlights policies and ethical issues in digital education and will provide insights into future trends in digital education. By the end of the course, students should have a thorough understanding of digital education and its various aspects, enabling them to design, develop, and manage digital learning programs effectively.

Brief synopsis:

This course on "Digital Education" covers various topics related to digital education, starting with an introduction to defining digital education and the benefits and challenges associated with it. It covers different learning theories that apply to digital education, online learning strategies, and pedagogical approaches for online teaching. The course also explores digital tools for education such as learning management systems, social media, collaborative tools, interactive multimedia, and artificial intelligence. Students will learn about instructional design principles for digital education, multimedia content creation, and adaptive learning design. The course also focuses on assessing and evaluating online learning programs through different types of assessments, rubrics, and open digital badges. It highlights policies and ethical issues in digital education such as copyright and intellectual property, privacy, security concerns, and accessibility and inclusivity. Finally, the course provides insights into future trends in digital education such as emerging technologies, predictive analytics, learning analytics, microlearning, and gamification.

Keywords: digital education, online learning, learning theories, pedagogical approaches, learning management systems, social media for education, collaborative tools, interactive multimedia, artificial intelligence in education, instructional design principles, adaptive learning design, assessment and evaluation in online learning, rubrics, open digital badges, copyright and intellectual property, privacy and security, accessibility and inclusivity, emerging technologies in education, learning analytics, gamification.

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3.2.2. Learning Outcomes

On successful completion of this course, graduates will be able to:

1. define digital education and explain its benefits and challenges;
2. apply different learning theories to digital education;
3. evaluate and select appropriate digital tools and platforms for education, such as LMS, social media, and collaborative tools;
4. design and develop effective digital content using instructional design principles and multimedia content creation tools;
5. develop different types of assessments and evaluate online learning programs using rubrics and open digital badges;
6. analyse policies and ethical issues related to digital education, such as copyright, privacy, security, and accessibility.
7. predict and analyse emerging trends in digital education, such as new technologies, learning analytics, open digital badges, artificial intelligence and gamification.
8. develop and manage effective digital learning programs, while adhering to ethical and legal standards, and staying up-to-date with emerging trends and technologies in the field.

3.2.3. Syllabus/Topics

Topic 1. Introduction to digital education

Topic 2. Learning theories and digital education

Topic 3. Digital tools for education

Topic 4. Designing and developing digital content

Topic 5. Assessment and evaluation in digital education

Topic 6. Policies and ethical issues in digital education

Topic 7. Future trends in digital education

3.2.4. Lessons

Topic 1. Introduction to digital education

Lesson 1.1 Defining digital education

Lesson 1.2 Historical background and evolution of digital education

Lesson 1.3 Benefits and challenges of digital education

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Topic 2. Learning theories and digital education

- Lesson 2.1 Behaviorism, cognitivism, and constructivism in digital education
- Lesson 2.2 Online learning strategies and models
- Lesson 2.3 Pedagogical approaches for online teaching

Topic 3. Digital tools for education

- Lesson 3.1 Learning management systems (LMS)
- Lesson 3.2 Social media for education
- Lesson 3.3 Collaborative tools and applications
- Lesson 3.4 Interactive multimedia for teaching and learning
- Lesson 3.5 Artificial intelligence in education

Topic 4. Designing and developing digital content

- Lesson 4.1 Instructional design principles for digital education
- Lesson 4.2 Creating multimedia content
- Lesson 4.3 Adaptive learning design and personalized learning

Topic 5. Assessment and evaluation in digital education

- Lesson 5.1 Types of assessment in online learning
- Lesson 5.2 Rubrics, open digital badges and other assessment tools
- Lesson 5.3 Evaluating the effectiveness of online learning programs

Topic 6. Policies and ethical issues in digital education

- Lesson 6.1 Copyright and intellectual property
- Lesson 6.2 Privacy and security concerns
- Lesson 6.3 Accessibility and inclusivity in digital education

Topic 7. Future trends in digital education

- Lesson 7.1 Emerging technologies in education
- Lesson 7.2 Predictive analytics and learning analytics
- Lesson 7.3 Microlearning and gamification

3.2.5. Assessment criteria

Outcome – Activity - Criteria

Topic 1.Introduction to digital education:

- 1.1 Write a reflective essay on the benefits and challenges of digital education.
- 1.2 Prepare a presentation on the historical background and evolution of digital education.

1.3 Conduct a case study on how digital education is being implemented in a specific context.

Topic 2. Learning theories and digital education:

2.2 Write a critical analysis of how behaviorism, cognitivism, and constructivism can be applied .in digital education.
2.3 Develop a lesson plan using an online learning strategy or model.
2.4 Create a video presentation comparing and contrasting different pedagogical approaches for online teaching.

Topic 3. Digital tools for education:

3.3 Develop a demo of a learning management system (LMS) or social media platform that can be used for education.
3.4 Create a collaborative project using a digital tool or application.
3.5 Design and develop an interactive multimedia resource for teaching and learning.

Topic 4. Designing and developing digital content:

4.4 Create an instructional design plan for a digital learning program.
4.5 Produce a multimedia project that includes various elements of instructional design principles.
4.6 Develop an adaptive learning design for a specific audience.

Topic 5. Assessment and evaluation in digital education:

5.1 Develop a rubric or open digital badge for an online learning activity.
5.2 Write a critical analysis of the effectiveness of a specific online learning program.
5.3 Design and conduct an evaluation of an online learning program using a selected assessment tool.

Topic 6. Policies and ethical issues in digital education:

6.1 Develop a policy framework for intellectual property and copyright in a digital learning context.
6.2 Create an accessibility and inclusivity plan for an online learning program.
6.3 Conduct a privacy and security risk assessment for a specific digital education scenario.

Topic 7.Future trends in digital education:

7.1 Conduct a literature review on emerging technologies in education.
7.2 Develop a learning analytics plan for a digital learning program.

Both differentiated and non-differentiated assessment of learning outcomes are used. Assessment is based on the level of the achieved learning outcomes. Learning outcomes are the knowledge, skills and attitudes or combinations thereof (competences) obtained as a result of studying.

Grades

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- **A** (excellent) – an outstanding and excellent level of achievement of learning outcomes characterised by free and creative use of knowledge and skills beyond a very good level.
- **B** (very good) – a very good level of achievement of learning outcomes characterised by purposeful and creative use of knowledge and skills. Un-substantive and non-conceptual errors may occur with regard to specific and detailed knowledge and skills.
- **C** (good) – a good level of achievement of learning outcomes characterised by purposeful use of knowledge and skills. Uncertainty and inaccuracies may occur with regard to specific and detailed knowledge and skills.
- **D** (satisfactory) – a sufficient level of achievement of learning outcomes characterised by the use of knowledge and skills in typical situations. Deficiencies and uncertainties may occur with regard to non-standard situations.
- **E** (poor) – a minimally acceptable level of achievement of learning outcomes characterised by limited use of knowledge and skills in typical situations. Significant deficiencies and uncertainty may occur with regard to non-standard situations.
- **F** (fail) – the level of knowledge and skills acquired by a student remain below the required minimum 'F' is a negative outcome and the examination/test etc shall be retaken.

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3.3.Online Course “Artificial Intelligence”

3.3.1. General

The growing digitization of society is a reality that we have been witnessing, with the adoption of products and technologies that have transformed our personal lives, revolutionizing our relationship with information and communication. At the organization level, digital transformation is also motivated by the dissemination of several innovative technologies, potentially transforming business. This course addresses the main aspects of Artificial Intelligence (AI) and modern Machine Learning (ML) techniques, with a perspective of the impact on modern organizations, contextualizing them in business and organizational scenarios of digital transformation.

The course will start by delimiting and defining the concepts of intelligence, AI and ML, followed by an overview of large areas within AI. Problem solving techniques are explored: for decision, search and optimization problems. Knowledge representation, as a key aspect, along with reasoning and uncertainty, is introduced, focusing on up-to-date methods. Besides the fundamental concepts of AI, studied since the 60s, recent developments in machine learning/deep learning and natural language processing (NLP) are introduced, by showing and experimenting with computational systems that are becoming increasingly available.

To develop and consolidate practical skills, challenge-based learning is proposed to the students, with some micro and medium size challenges, founded on real problems, and, if possible, in the context of industry or research partnerships.

Keywords: artificial intelligence, machine learning, intelligent agents, natural language processing

3.3.2. Learning Outcomes

On successful completion of this course, graduates will be able to:

1. Define what is artificial intelligence and main concepts and questions
2. Analyze an intelligent agent, specifying its performance, analyzing environment characteristics and the characterize the different types of agents
3. Understand and use of machine learning techniques, such decisions trees, neural networks and k nearest neighborhoods, with real data.
4. Apply NLP models through available libraries

3.3.3. Syllabus/Topics

1. Artificial intelligence: main concepts and questions

2. Intelligent agents, performance, environment characteristics, different types of agents
3. Machine learning techniques: decisions trees, neural networks and k nearest neighborhoods, with real data.
4. NLP models and available libraries

3.3.4. Lessons

1. Overview of Artificial Intelligence
    a. Problem solving
    b. Knowledge representation and reasoning
    c. Machine Learning
    d. Communication, perception and action
2. Intelligent Agents
    a. Characterization of an Agent
    b. Properties of the environment
    c. Types of Agents
3. Introduction to Machine Learning: Learning from Examples
    a. Decision trees
    b. K nearest neighborhoods
    c. Neural networks
4. Natural Language Processing techniques
    a. Topic modelling with Latent Dirichlet Allocation (LDA)
    b. Word embeddings with Word2Vec
    c. Large Language Models

3.3.5. Assessment criteria

Outcome – Activity - Criteria

- Challenge 1: write an essay to one provocative question, and maintain a conversation with chatGPT about it, exploring the differences found between your essay and the chatGPT answer. Deliver a report and read/evaluate three reports.
- Challenge 2: characterize two intelligent agents, and compare with the official answer. If the results do not match, write a report with your justification on the differences.

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- Challenge 3: select from a Sustainable Development Goal (SDG), one indicator, and collect data. Use the three machine learning techniques to predict the selected indicator. Write a report with the findings, with not only the differences between ML but also with the most important factors that affect the selected indicator, and in what way.
    - **Big idea**: use country data over the years do identify what is important to a SDG
    - **Essential question**: can an indicator of a SDG be learned by a ML, if available relevant macro country data?
    - **Challenge**: select one indicator from one SDG, collect data related to the indicator, and try to use three machine learning techniques to predict the indicator
    - **Guiding questions**: document with the tasks of the challenge
    - **Guiding activities, resources**: document with the tasks of the challenge, country data in: https://www.pordata.pt/en/home
    - **Analysis**: ?
    - **Solution**: this is an open challenge, exist no solution, and each student investigate its own indicator
    - **Implementation**: ?
    - **Evaluation and sharing**: students submit the report in a Workshop of Moodle, for peer assessment. Is required to read/evaluate 3 reports, but students can read/evaluate as many as they want.
- Challenge 4: cluster some topics in a text corpus using LDA algorithm, identify those topics and write a report on the results obtained

The reports in each challenge are peer reviewed according to the description of the task and lessons learning from the experience.

3.3.6. References

Bibliography:

- *Artificial Intelligence: A Modern Approach*, Stuart Russell, Peter Norvig, Prentice-Hall.

Other resources:

- Pedagogical videos
- R/Python libraries for AI
- Tutorials (text and video format)

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3.4.Online Course “Robotics and IoT”

3.4.1. General

Aim of the course

The aim of this course is to provide a comprehensive understanding of Internet of Things (IoT) and Robotics, its benefits and future challenges for society. Also this course aims a basic understanding of approaches of applying IoT and Robotics technologies in different fields, as industry, service, agriculture, household, education, smart home, entertainment and in the military. The course will provide knowledge about the Infrastructure of IoT (Internet of Things) as interconnected communicating devices, its essential hardware, software platforms, protocols, Servers and Cloud Networks. Also it conveys knowledge of its mechanical systems, sensors, actuators and microcontrollers. Related methodology and tools for applying IOT and Robotics are to be taught, as agile development, design thinking, user experience and user interface design, simulation tools, cloud computing, open-source Tools and programming languages. The course will provide an orientation about policies and ethical issues around data privacy, security and rights of humans or the environment. Finally the course gives insights into future trends for applying IoT and robotics in various domains. After completion of the course, students will have acquired a fundamental understanding of key aspects of IOT and robotics. They will be able to design and model IOT robotics solutions, taking into account the most important aspects of implementation and evaluation.

Brief synopsis:

The course on IoT and Robotics covers a wide range of topics related to Internet of Things (IoT) and robotics. It provides an introduction to the definition of IoT and robotics, and the benefits and challenges associated with their integration. The course covers different IoT and robotics technologies, their applications in various fields. It also covers the design and development of IoT and robotics systems, including hardware, software, and network architectures, user interfaces and control systems. The course explores the ethical and legal issues related to privacy, security, and job displacement. The course also provides insights into future trends in IoT and robotics, such as cobots, swarm robotics, edge computing, autonomous vehicles, and smart cities. The course aims to equip students with the basic knowledge and skills needed to design IoT and robotics systems for simple applications and an overview about its development and implementation.

Keywords: Actuator, Automatization, Autonomous Vehicles, Cloud Network, Cobots, Data Analytics, Edge Computing, Emerging Technologies, Ethical Implications, Internet of Things, IoT Hardware, IoT Software, Network Architectures, Privacy and Security, Robot Control System, Robot Infrastructure, Robotic Technologies, Robotics, Robots, Sensor, Server, Smart Cities, Smart Health, Smart Vehicles, Smart Buildings, Swarm Robotics.

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3.4.2. Learning Outcomes

Upon successful completion of this course, the learners will be able to:

1. define IoT as connected devices, sharing data to enable automation and optimization and
2. define robotics and explain its benefits and challenges of IoT and Robotics in terms of technical, human and economic implications of IoT and Robotics
3. apply different theories of IoT and Robotics to fields of application
4. explain IoT and Robotics technologies, including data communication between devices, sensors, actuators, controls, cloud network, server, standards and protocols
5. explore appropriate digital tools and platforms for programming IoT and Robotic Systems on a no-code level.
6. analyze and reflect ethical issues related to IoT and Robotics as privacy, security, and job displacement a.o.
7. predict and analyze emerging trends in IoT and Robotics, such as chatbots, swarm robotics, edge computing, autonomous vehicles, and smart cities and understand the current and future development of IoT and Robotics and how they will impact society and the workplace
8. conceptualize, design and model a user centered IoT/robotic solution using methods of design thinking and user experience design
9. Build and test prototypes for IoT and robotics solutions, optionally apply a no-code-tool (arduino/scratch) for prototyping

3.4.3. Syllabus/Topics.

1. Introduction to Internet of Things (IoT) and Robotics
2. Application of Internet of Things (IoT) and Robotics
3. Functionality of IoT Devices and Robots
4. Development of IoT and Robot based Solution
5. Designing and modeling IoT/robotic based scenarios

3.4.4. Lessons

Introduction to the course:

Overview of the course-topic, -structure, procedure, support materials, chatbot.

Start CLB Phase 1 – Engage:

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Learners are introduced to the first topics and a given challenge related to a problem to be solved with IoT and robotics including: Big Idea, Essential Question, Guiding Questions. From this learners develop further leading questions of their own to specify and plan their learning project.

Topic 1: Introduction to Internet of Things (IoT) and Robotics

Lesson 1.1 Definition of IoT: theory, benefits and challenges

Lesson 1.2 Definition of robotics: theory, benefits and challenges

Lesson 1.3 Historical background and evolution of IoT and Robotics

End CLB Phase 1 – Engage: Learners reflect their learnings and define new guiding questions

Start CLB Phase 2 – Investigate: learners deepen their understanding of the topic

Topic 2: Application of Internet of Things (IoT) and Robotics

Lesson 2.1 Application areas and development trends in terms of case studies

Lesson 2.2 Technical feasibility, market feasibility, and financial feasibility.

Lesson 2.3 Ethical and social implications of IoT and Robotics.

Lesson 2.4 Learners reflect their learnings and define new guiding questions

Topic 3: Functionality of IoT Devices and Robots

Lesson 3.1 Mechanics, electronics, and controls

Lesson 3.2 Sensors and actuators, different types and use

Lesson 3.3 Network Communications, protocols, standards as TCP/IP, HTTP, MQTT, ROS

Topic 4: Development of IoT and Robot based Solutions

Lesson 4.1 Development process: analyze, define, ideate, implement, optimize

Lesson 4.2 Code based Programming languages such as Python or C++

Lesson 4.3 No Code Programming Tools such as Scratch

Lesson 4.4 Data Analysis and Computer visualization

Lesson 4.5 Machine Learning

End CLB Phase 2: Learners reflect their learnings and define new guiding questions

Start CLB Phase 3 – Activate: learners begin to apply their understanding of IoT and Robotics in a practical exercise / project

1. Topic 4: Designing and modeling IoT/robotic based scenarios

Lesson 4.1 Analyzing a problem related to guiding questions and defining needs

Lesson 4.2 Ideation, conceptualization and design of a solution

Lesson 4.3 Modeling user scenarios and use cases

Lesson 4.4 Prototyping and functional testing, bug analytics and fixing

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Lesson 4.5 Feedback: learners show prototype to an audience and get feedback Lesson

End CLB Phase 3: Learners reflect on their learnings by referring to their guiding questions

End CLB: Learners reflect on their entire learnings by referring to their essential question.

3.4.5. Assessment criteria

Outcome – Activity - Criteria: Please note: following outcomes are initially optional and need to be adapted according to the practical CLB scenario which will be developed in PR. 4.

Topic 1: Introduction to Internet of Things (IoT) and Robotics

1.1 Write a reflective essay on the benefits and challenges of IoT: 4-5 pages, comparison, swot in terms of social, economic and technical implications

1.2 Write a reflective essay on the benefits and challenges of Robotics

1.3 Prepare a presentation on the historical background and evolution of IoT/Robotics

1.4 Write a critical analysis of how the Cognitive Load Theory can be applied in robotics.

Topic 2: Application of Internet of Things (IoT) and Robotics

2.1 Conduct a case study on how IoT/Robotics are being implemented in a specific context

2.2 Create a slideshow about technical, market and financial feasibility of IOT and robotic

2.3 Write a critical analysis on the ethical and social implications of IoT and Robotics

2.4 Create a presentation reflecting the previous learnings and define new guiding questions.

Topic 3: Functionality of IoT Devices and Robots

3.1 create a canvas showing and declaring the basic mechanics and electronics of IoT/Robotics

3.2 explain with an example case different types and use of sensors and actuators

3.3 create a short presentation about Network communications, protocols, standards

3.4. Assemble a simple programmable robot. use the mBot (Link)

Topic 4: Development of IoT and Robot based Solutions

4.1 plan a development process: analyze, define, ideate, implement, optimize for your mBot

4.2 Explore a no-Code programming Tool such as Scratch (for beginners) write a reflection

4.3 Explore a programming Tool such as Python or C++ (for advanced), write a reflection

4.4 create presentation about Data Analysis and computer visualization

4.5 create a Slideshow about Machine Learning

Topic 5: Designing and modeling an IoT/robotic based scenario

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4.1 Analyzing a problem related to guiding questions and defining needs

4.2 Ideation, conceptualization and design of a solution

4.3 Modeling user scenarios and use cases

4.4 Prototyping and functional testing the mBot using experiences from Topic 3 and 4

4.5 sample and document Feedback on the prototype from an external audience

4.6 write a reflect on the learnings by referring to their guiding questions

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